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July 1988

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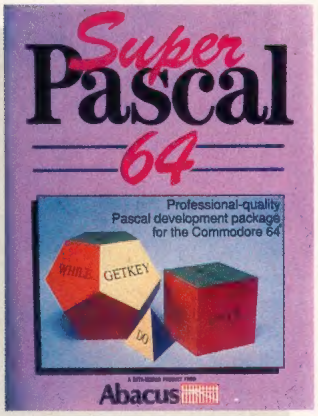

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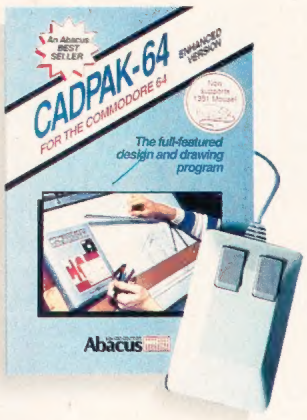

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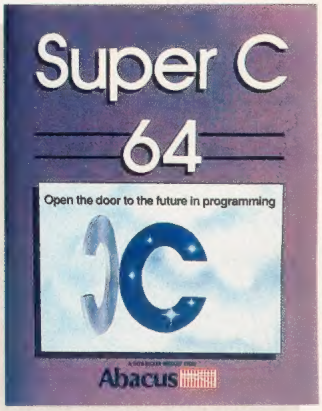

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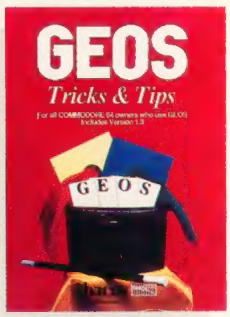

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COMPUTE!'s GAZETTE

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*=General, **64**=Commodore 64, **+4**=Plus/4, **16**=Commodore 16, **128**=Commodore 128

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editor's notes

As you may have noticed on the cover, this issue marks a milestone—it's our fifth anniversary. In looking over the contents of the debut issue (July 1983) and comparing them with this one, it's easy to see not only the evolution of a magazine, but also that of an industry.

Just a glance at the 1983 table of contents tells you that VIC-20 coverage exceeded that of the 64. The main feature of that first issue was "Does Your Computer Need a Cassette Recorder?" The reviews section included close-up looks at the Exatron Stringy Floppy—a high-speed, minicassette storage device priced at $200—and the *Deadly Duck* cartridge game for the 2K VIC ($35). Programs in that issue included "VIC Timepiece," a graphic display of balls rolling through chutes to mark the passing of seconds and minutes; "VIC Marquee"; and "Alfabug," a race involving six bugs trying to get from the right side of the screen to the left.

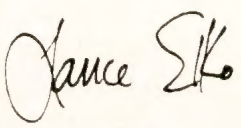
And we handled reader questions such as "If I buy preprogrammed cassettes from Timex or Atari, can I play them on my VIC-20?"

While you're smiling, try to remember what computing was like in the summer of '83. It would be ludicrous in 1988 to publish any of the articles or programs from that issue, but the debut magazine was received with accolades and a tidal wave of subscription forms. And while its contents can elicit a few laughs now (and perhaps a bit of nostalgia), so can the advertisements. There's the Universal Tape Interface and Duplicator ($49), a ten-key numeric keypad ($70), a 24K memory-expansion board for the VIC ($149), and an "under $600" Commodore 64.

All of the programs in that first issue were written in BASIC. Machine language programs did not emerge until several months later, and for the next year were published sparingly. As the magazine grew, so did the readers and users who programmed. We began writing about machine language, and, correspondingly, we received an increasing number of machine language programs, each batch more ambitious and sophisticated than the previous one. The quality of the BASIC programs increased dramatically as well. When it became apparent that we had a consistent flow of outstanding software, we broke ground with a disk product. The *GAZETTE Disk* was born in May 1984, and it remains a key component of our publications group.

All of these developments have taken place in an environment in which three, and even four, years ago, many industry observers predicted the quick decline of an eight-bit Commodore computer market. The obvious correlation is that we, the *GAZETTE*, should have long been buried as well. So there's a lot to celebrate on this fifth anniversary. We have an active, healthy readership and some exciting future plans. It also affords us the opportunity to say a special thanks to you, our readers, for your loyalty and support.

Two more comments. It's interesting to note that in our first issue, we covered the tape drive as the most popular data-storage device. In this issue, we have an exciting feature on a different kind of storage device: the hard drive. Also, we're not the only ones celebrating an anniversary in July. This month marks the 125th anniversary of the Battle of Gettysburg. In keeping with our reflective mood, we've included "The Civil War on Disk," a feature that we think everyone will enjoy.



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HOT. MEAN. RADIO-ACTIVE.

AUGUST 20, 2087

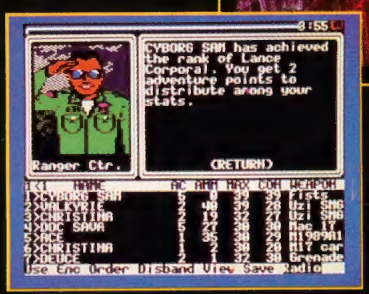
Nothing could be worse than this god-forsaken, radioactive desert.

More Sniperdroids! All tracking me with them death glares. And them Uzis. They're weird trigger-twitchin' folks. I suspect it's them poisoning the water.

Or maybe it's those Leather Thugs. Heck, I don't know anymore. I heard they have a bunch of civilians cut off east of Ranger Center, which is where I'm headed. Hope not. They want me dead. Like every other mutant this side of Vegas.

The worst part is, I'm getting to be as bad as they are. You wouldn't believe some of the ways I've learned to kill. I hang out in sewers, and my best friend is a MAC 17 submachine gun.

Gramps talked about life before the nuclear war. All I know is I don't want others living this way. Gotta rebuild this desert right. Gotta make it so you can sleep with your eyes closed.



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letters to the editor

The Rumor Mill

A reader from California called recently to tell us that a number of bulletin boards and user groups have been reporting the imminent demise of GAZETTE. *And the editor of a rival publication called recently to ask if we would comment on the rumor that we were going out of business. To those who have been propagating this rumor or to those who may have heard it, we'd like to respond with "no, nyet, nah, nope, nein, and not a chance."* GAZETTE *has consistently had the largest circulation of any Commodore magazine since our start-upfive years ago this month, and we still have the largest. We don't know how these rumors got started, but we would like everyone to know that we're doing just fine. And we plan to serve our readers for a long time to come.*

Taking Exception

I think Rich McIntyre made a mistake during your interview with him in the May issue. He stated, "There's no recreational software per se written for the 128." I have *Bureaucracy* and *Beyond Zork*, both from Infocom.

I also take exception to "The View from Activision" by Bruce Davis. First he remarks that Commodore needs to improve its price/value relationship (by claiming that the 64 has been selling at the same price, with the same features, for quite a few years). He then admonishes Commodore to either lower the price or add features. What else in this world of inflation has held the line and not had price increase?

Mr. Davis then goes on to bemoan what he calls a "price degradation" only on the 64 software. Is that not what he just previously requested from Commodore? It seems to me that Mr. Davis wants to have his cake and eat it, too!

Frederick R. Claus
Frankfort, KY

Call to 128 Programmers

In response to Matt Getman's letter (April), I totally agree that there should be more support for the 128. I am not an avid programmer, but I have a suggestion to those of us who are: Write a program for the 128 and put it on the market.

Edward Grenga, Jr.
Syracuse, NY

The attitude of many software companies is that if you own a 128, you own a 64, and, thus, a 64 product can be marketed to both 64 and 128 users. (Remember, there are ten million 64 owners.) This is the major reason why there have not been a lot of commercial 128 releases.

When you admonish 128 programmers to put their wares on the market, we'd like them to consider GAZETTE *as a publisher. We run the best of what we get for the 128, but the overwhelming majority of program submissions we receive are for the 64. So, yes, 128 programmers, we agree with Matt and Edward—write some good software, and don't forget that we'd be delighted to see it.*

GAZETTE Index?

Do you have an index that covers the multitude of articles, programs, hints, etc., from the first issue to date?

Burr White
Richmond, VA

We have a large file comprised of letters of request for an index. While we don't have one available now, we do have one in the works. It will be available on disk later this year, and will include every issue from July 1983 through December 1988. Look for details beginning in the October issue.

128D Blues

I got my 128D back after a month in the shop and one program later my drive failed again. The technicians at the authorized Commodore facility told me there had been quite a few 128Ds coming back for repair. It seems there is a design deficiency in the drive door lever mechanism. If the drive door is not handled with extreme caution, irreparable damage may result to the internal drive—it must be replaced, at about the cost of an external drive. There is nothing in the 128D manual warning of this situation. I had to hear it from the repair shop after it was too late.

Donald A. Weaver
Osawatomie, KS

We've not had any problem with the 128D drive here at the office, nor have we had any readers reporting this kind of trouble. A Commodore representative told us that while they are not aware of any problem with the 128D drive, it is true that if a drive door lever were bent or twisted, the entire drive would be seriously damaged. Since the repair persons in your area noted that several 128Ds have been returned, you could suspect that your drive was one of a bad shipment.

If any other readers have had this problem, we'd like to hear from you.

New 64?

I've heard rumors of a 64D, a Commodore 64 with a built-in disk drive. Do you have any information on this?

Rachel Bimpers
Bozeman, MT

At the recent Software Publishers Association (SPA) Spring Symposium in Berkeley, California, Commodore held a seminar and emphatically denied the existence of such a machine, but added that the company had heard this of rumor for some time. Representatives noted that there are no current plans to modify the existing 64 or 128D, both of which continue to sell very well. They also stated that Commodore is still selling annually more than a million 64s—about half of these in the U.S.—with minimal promotional activity.

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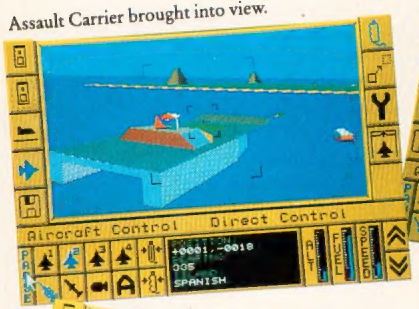
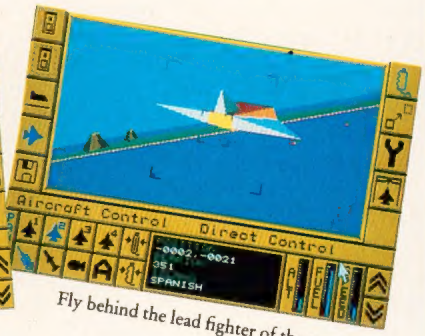
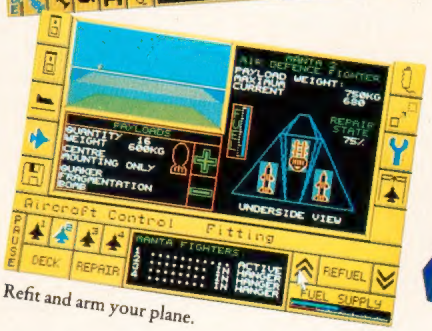




Fly behind the lead fighter of the squadron.



Refit and arm your plane.

Screenshots from Atari ST.

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Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s Gazette, P.O. Box 5406, Greensboro, North Carolina 27403. We regret that, due to the volume of mail received, we cannot respond individually to programming questions.

Saving Arrays

I need to know if you can save two- and three-dimensional arrays to file. If so, please write a program to save them to and load them from a file.

Kingston Cassidy
East Port Orchard, WA

Multidimensional arrays can be stored in a file as long as you're careful about the order in which you write and read the data. The following program writes a two-dimensional array to disk, clears the array, and reads the data back into the array. (Tape users: Follow the directions in the REM statements. You will also need to rewind the tape when the message READ THE ARRAY FROM THE FILE . . . appears.)

```
CC 10 X=10:Y=3:REM THE SIZE OF
      THE ARRAY
KP 20 DIM AR(X,Y)
QX 30 PRINT"FILL THE ARRAY WIT
      H RANDOM VALUES..."
GP 40 FORI=1TOX:FORJ=1TOY:REM
      {SPACE}FILL THE ARRAY WI
      TH RANDOM INTEGERS
KF 50 AR(I,J)=INT(RND(1)*10):P
      RINT AR(I,J);"{2 SPACES}
      ";
MK 60 NEXTJ:PRINT:NEXTI
FE 70 PRINT "SAVE THE ARRAY TO
      DISK..."
SF 80 OPEN15,8,15,"S0:ARRAY":C
      LOSE15:REM TAPE USERS RE
      MOVE THIS LINE
AD 90 OPEN1,8,2,"0:ARRAY,S,W":
      REM TAPE USERS REMOVE TH
      IS LINE
BK 100 REM OPEN 1,1,1,"ARRAY":
       REM TAPE USERS REMOVE T
       HE FIRST REM FROM THIS
       {SPACE}LINE
SG 110 PRINT#1,X:PRINT#1,Y:REM
       SAVE THE SIZE OF THE A
       RRAY
RJ 120 FOR I=1TOX:FORJ=1TOY:PR
       INT#1,AR(I,J):NEXTJ,I:R
       EM SAVE THE ARRAY ITSEL
       F
RD 130 CLOSE1
KH 140 PRINT"CLEAR ALL VARIABL
       ES...":CLR
QG 150 PRINT"READ THE ARRAY FR
       OM THE FILE..."
KA 160 OPEN1,8,2,"0:ARRAY,S,R"
       :REM TAPE USERS REMOVE
       {SPACE}THIS LINE
HF 170 REM OPEN 1,1,0,"ARRAY":
       REM TAPE USERS REMOVE T
       HE FIRST REM FROM THIS
       {SPACE}LINE
GQ 180 INPUT#1,X,Y:REM READ SI
       ZE OF ARRAY
DC 190 DIM AR(X,Y):REM DIMENSI
       ON THE ARRAY TO SIZE X,
       Y
GR 200 FOR I=1TOX:FORJ=1TOY:IN
       PUT#1,AR(I,J):PRINTAR(I
       ,J);"{2 SPACES}";:NEXTJ
       :PRINT:NEXTI
CH 210 CLOSE1
```

Line 80 opens the file as a sequential file for writing. You must explicitly tell BASIC that you want to write to the file; otherwise it will assume you want to read the file.

Line 110 writes the size of the array to the file. It's necessary for the program reading the file to know how large to dimension its array.

Lines 120 and 130 write the array data to the file and close the file.

Line 160 opens the file as a sequential file for reading. Because BASIC assumes that you want to read a sequential file, line 160 could be entered as **160 OPEN1,D,2,"0:ARRAY"**.

Lines 180 and 190 read the size of the array from the file and dimension a new array of that size.

Line 200 reads the data from the file into the array and prints each value to the screen.

As an experiment, exchange the variables X and Y in lines 190 and 200.

Unscrambling Sprites

I am making a game that uses 20 sprites in memory at 8192 and a hi-res screen at 24576, which I created with *Doodle*. The problem occurs when I switch to hi-res and turn on the sprites. The picture is fine, but the sprites are scrambled. Can you tell me why this happens and how to overcome it?

Chris Cole
Barberton, OH

In this case, it's not a memory conflict, but a hardware feature that's causing the problem. As mentioned above, the VIC-II chip can handle only 16K of memory at any one time. The four video banks use the following sections of memory:

bank 0	*0–16383*
bank 1	*16384–32767*
bank 2	*32768–49151*
bank 3	*49152–65535*

The hi-res screen and the sprite shapes must occupy the same video bank. A Doodle *screen uses locations 24576–32575, and the color memory loads at 23552. That leaves you 7K of available memory in video bank 1—from 16384 to 23551—which is much more than you need for 20 sprites. Since sprites use 64 bytes each, you can start the sprite shapes at 23552–1280 or at location 22272 (instead of location 8192).*

*Two things change when you move the sprites up in memory. Instead of using POKE 55,0: POKE 56,92 to move the top of BASIC down, preventing it from interfering with the screen, you must use POKE 55,0: POKE 56,87, because 87 * 256 is 22272.*

The sprite pointers also move. Instead of locations 2040–2047, use locations 24568–24575, which are at the end of hi-res color memory. The offsets are calculated relative to the start of the video bank. To point to the sprite at 22272, subtract 16384 and divide by 64. POKE the resulting value (92) into one of the eight pointers. POKE 24575,92, for example, to give the shape at 22272 to sprite 7.

80 Columns

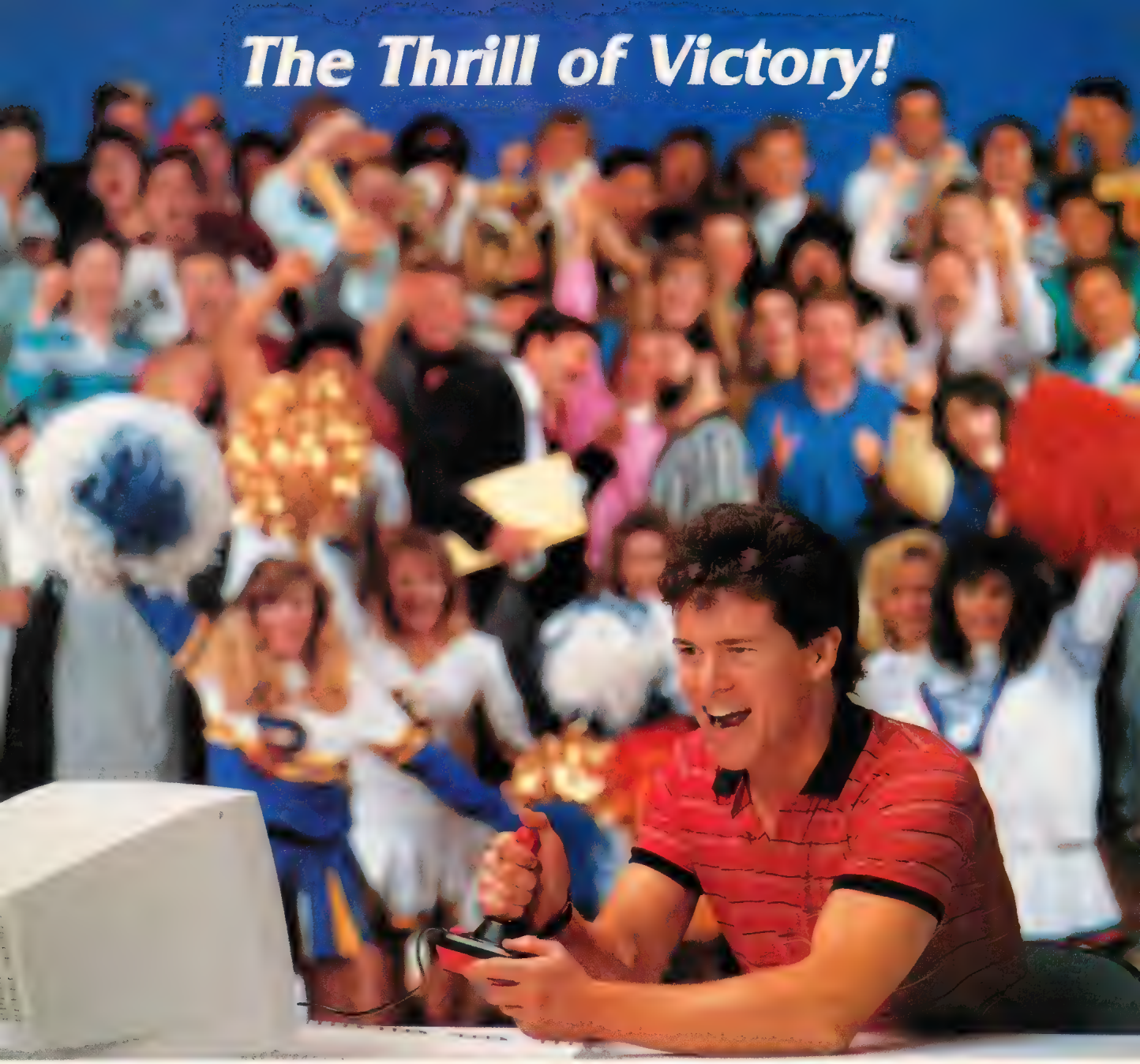
I am considering the purchase of a Commodore 64. I want an 80-column cartridge and a 128K RAM expansion and a word processor that utilizes them. I know these items are available for Apple computers. Do you have any advice or suggestions?

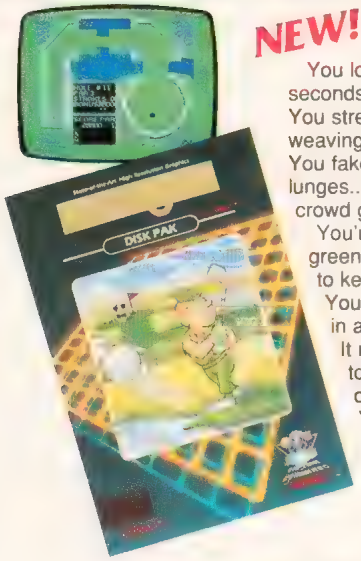
Mel Anderson
Houghton, MO

One of the differences between the Apple II series and the Commodore 64 is expandability. The Apple has expansion slots, permitting easy additions. The 64 has a cartridge port designed primarily for software, not expansion.

In the past, there have been 80-column

The Thrill of Victory!





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cartridges for the 64, but they did not generate a crisp display. If you require 80 columns, you're better off buying a Commodore 128. Here is a list of word processors that work in 80-column mode:

Fontmaster 128, *$69.95*
Xetec
2804 Arnold Rd.
Salina, KS 67401

PaperClip II and III, $79.95
Batteries Included
(distributed by Electronic Arts)
1820 Gateway Dr.
San Mateo, CA 94404

Pocket Writer 2, *$49.95*
Digital Solutions
2-30 Wertheim Ct.
Richmond Hill, Ontario
Canada L4B 1B9

Superscript 128, *$79.95*
Progressive Peripherals & Software
464 Kalamath St.
Denver, CO 80204

Term Paper Writer, $39.95
Activision
2350 Bayshore Frontage Rd.
Mountain View, CA 94043

Word Writer 128, *$69.95*
Timeworks
444 Lake Cook Rd.
Deerfield, IL 60015

GAZETTE *also has a fine 80-column word processor for the 128:* SpeedScript 128. *It was published in the October 1987 issue and on that issue's companion disk.*

Memory Management

I'm working on a game for the 64. It contains redefined characters and makes extensive use of three-dimensional arrays. The problem is that when the program gets to a certain length, the screen turns to trash when I run it. Nothing can be deciphered except for reversed characters. Can you help? I think the problem is a memory limit. If it is, could it be corrected if I rewrote the program in 128 mode?

Abe Kauffman
Payette, ID

The problem you describe is a typical memory conflict. Within your program, you've put the new character shapes in a certain chunk of memory. Later, as the program uses variables, BASIC ends up storing the variable values in the same memory where the character shapes are. The screen isn't turning to garbage; the individual character shapes are. The reverse character shapes are in the second half of the character set, so they're the last to be trashed.

The Video Interface Chip (VIC-II) handles all video-related jobs, including display of the character shapes. The VIC-II chip can access only 16K of memory at any one time. The default video bank is 0 (from location 0 to location 16383), which means that the screen, the sprite shapes, and the custom character shapes must all reside within that 16K section. Since a complete character set uses 2048 bytes, it's fairly common to use the 2K at the top of the video bank. This puts the characters at 14336–16383.

The BASIC language built into the 64 requires a continuous section of memory. The computer uses locations 0–1023 for its own purposes. Screen memory and sprite pointers occupy 1024–2047. The first byte available for BASIC is 2048. Read only memory (ROM) starts at 40960, which means that, in normal situations, BASIC controls all of the memory from 2048 to 40959. But what about the custom characters at 14336–16383? That's somewhere in the middle of the memory BASIC thinks it owns. When your program runs, BASIC assumes it can use any and all of the available memory, which sets the scene for custom characters that turn to garbage. As the BASIC program uses more and more variables, they gradually fill up memory and, in the end, overwrite your character shapes.

There are two solutions: Move the characters or move BASIC. Moving the character set involves changing video banks, which also means you have to move the screen and the HIBASE pointer at 648. Plus, you must either avoid pressing RUN/ STOP–RESTORE or disable the RESTORE key (see below). It's easier to move BASIC. To transfer the start of BASIC from 2048 to 16384 (which is just past the end of your character set), enter these lines in direct mode before you load your program:

```
POKE 43,1: POKE 44,64: POKE 16384,0:
  NEW
```

Plus Means 0–127

I have a question regarding the machine language BPL instruction. I've enclosed a program that doesn't work with BPL. I've managed to make the program run correctly with BCS, however.

Wayne Dooley
Winchester, VA

ML programmers tend to think that bytes hold values in the range 0–255, which is true. It's just as true to say that bytes can hold positive values from 0–127 and negative values of 128–255. Like a clock, bytes have a wraparound point. A clock displays the hours 1–12 and then starts over at 1. A memory location can count from 0–255 before it starts over at 0.

The positive number 255 can be regarded as −1. Thus, 254 is −2, and so on. If you think in terms of clock arithmetic, ten hours is the same as minus two hours (four o'clock plus ten hours is 14:00, which is two o'clock, so 4 + 10 = 2).

The machine language BPL instruction stands for Branch if PLus, which can be tricky. The status register holds a negative flag that keeps track of positive or negative values. For instance, 15−13 is 2 (a plus result) and 13−15 is −2 (also called 254, which is minus). But 254−3 should be 251, which you might consider a positive number. It's not: 254 is a negative number (−2), and when you add a −3, the answer is −5 (251). Just remember that absolute values of 0–127 are positive and the absolute values of 128–255 are negative. If you're using BPL and BMI commands, also remember that there are two points where the sign changes: from 255 (minus) to 0 (plus) and from 127 (plus) to 128 (minus).

Magic POKEs

I am writing a program for the 64 and need to disable and enable some keys. Is there a routine that shows me the values to POKE to disable or enable a key?

Jose L. Stephens
Santiago, Chile

You didn't say which keys you wanted to disable, so here are two answers.

If you're trying to limit keyboard input to certain keys, you can do it with a series of IF-THENs:

```
400 PRINT "NORTH, SOUTH, EAST,
    OR WEST?"
410 GET A$: IF A$ = "" THEN 410
420 IF A$ = "N" THEN 500
430 IF A$ = "S" THEN 600
440 IF A$ = "E" THEN 700
450 IF A$ <> "W" THEN 410
```

There's no need to explicitly disable the other keys when you can write a program to filter out the acceptable answers. Note that line 450 checks for the final character and goes back to 410 if it's not W. If the user types a W, the program falls through to the next line.

Software Security Key

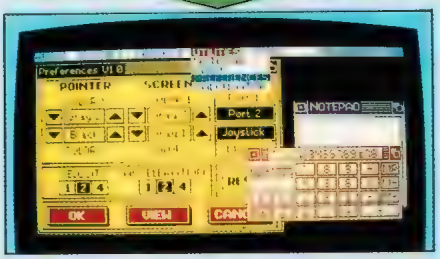
I recently purchased a game that included a security key that plugs into the cassette port. What is the purpose of this key and is it safe to leave it in the cassette port when running any other programs?

Wayne Addington
Winchester, WI

The purpose of the security key (also known as a dongle) is to prevent software piracy. The key is one of several protection schemes designed to stop illegal distribution of programs.

The buyer can make as many backup copies of the program as he or she needs, but pirates cannot run these copies without the security key. Programs that use the tape drive must have the key unplugged. Other programs should function properly, but to be on the safe side, disconnect the key.

KEEP IT SIMPLE!



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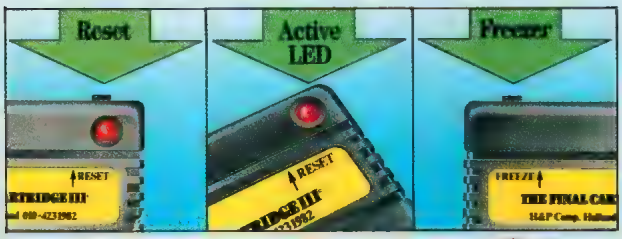

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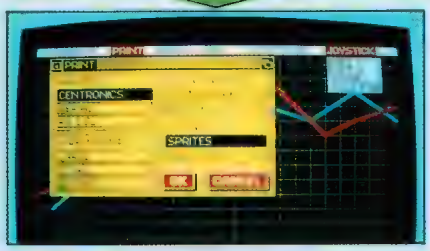

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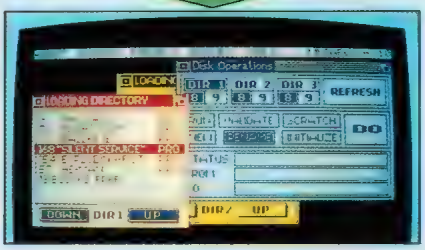


THE FINAL CARTRIDGE III

The high-resolution bit mapped windows are selected from a menu bar. An unlimited number of windows can be open on the screen at the time. The windows can be freely moved on the screen.

The following windows are already implemented in ROM:

PREFERENCE WINDOW
Selects: mouse port, joystick port, mouse speed, screen colours, pointer colours, keyboard click, keyboard repeat.

CALCULATOR
Complete simulation of a LCD-calculator. Input either with mouse, joystick or keyboard. The numeric key-pad of the C128 can be used in C64-mode.

NOTE PAD
Easy to use wordprocessor with proportional characters enables you to store and print small notes, letters, etc.

DIRECTORY WINDOWS
Enables you to open directories from different disks and drives, sort and print directories.

DISK WINDOWS
Load, Run, Rename, Validate, Scratch, Initialize, Fast format disks.

TAPE WINDOW
Activates fast and normal modes.

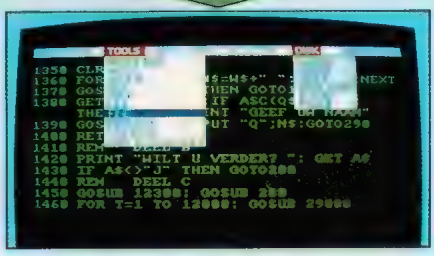
PRINTER WINDOWS
Select different printers, such as Commodore serial, Centronics, RS 232, Colour printers.

REQUESTER WINDOWS

DISC BASED USER WINDOWS

CLOCK
Real Time Clock, with Alarm.

PULL DOWN MENU



THE FINAL CARTRIDGE III

Almost all commands and functions that are not activated by windows can be selected from a menu bar, which appears on top of the screen after pressing the fire button, either in Basic or from the freezer. The following Basic Toolkit and keyboard extra's are included:

● Renumber ● Auto ● Delete ● Old ● Help ● Kill ● Find ● Replace ● 24K extra RAM for Basic ● Append ● DAppend ● DSave ● DOS ● Monitor ● Drive monitor ● Sprite editing ● Centronics interface ● Fast format ● Low Res screen-dumps ● Plist ● Scrolling up and down ● Stops and continues listings ● Programmed functionkeys ● Packer/Cruncher ● Hex to decimal conversion ● Pokes, syscalls and variables may all have Hexadecimal values ● Trace, Dump, Order, Mem.

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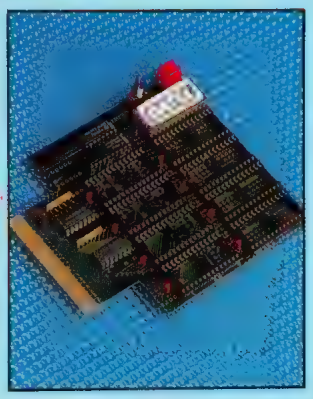

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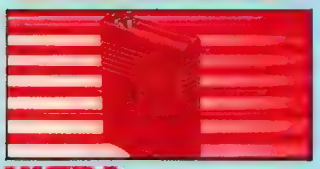

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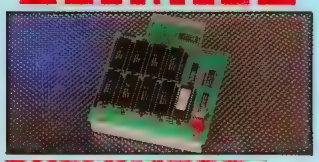

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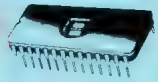

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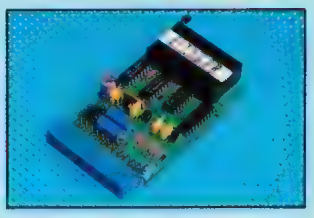

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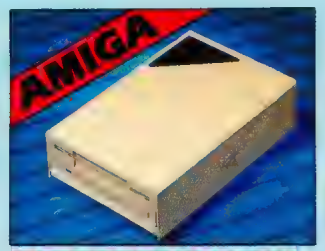

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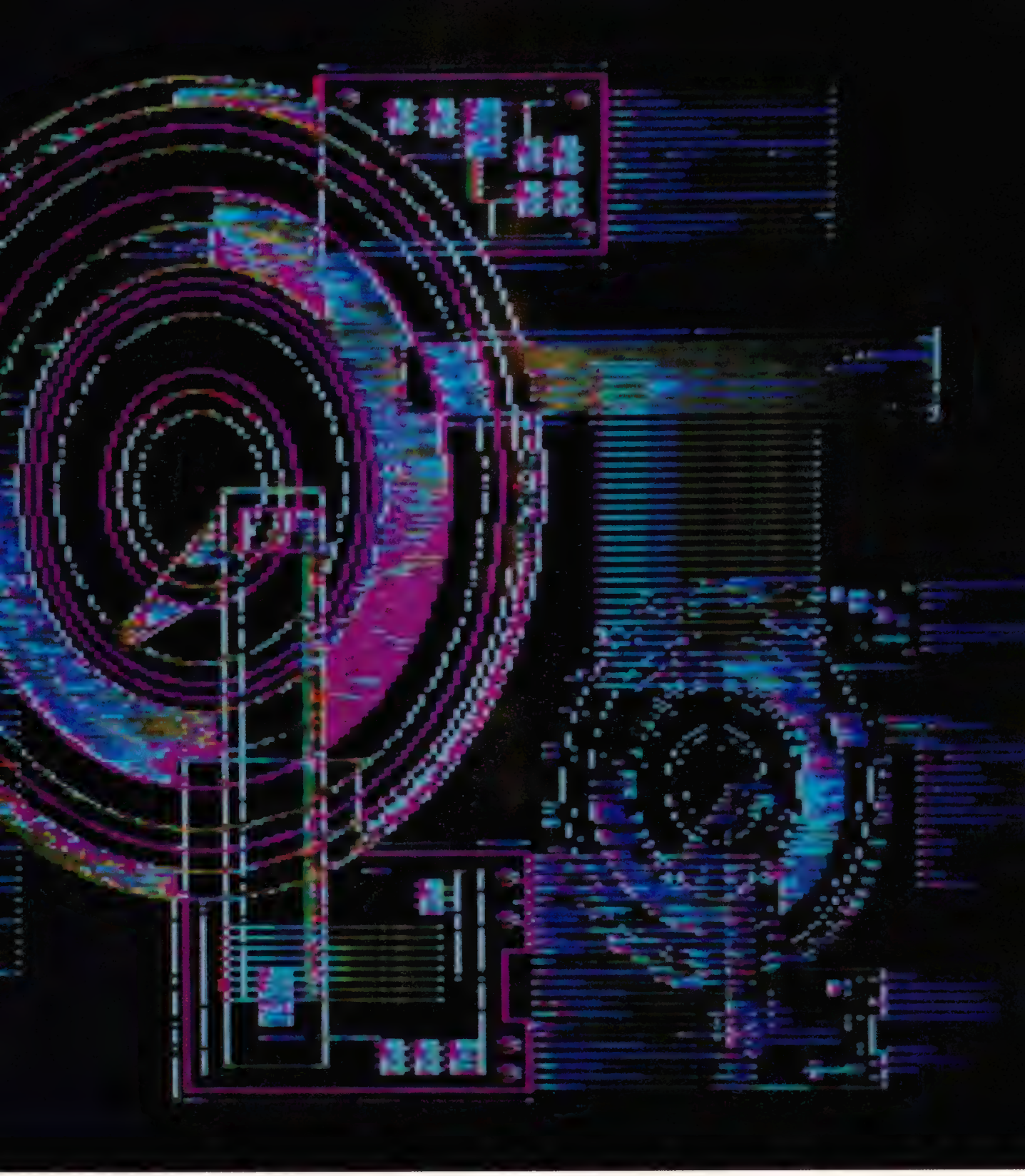
Hard Disk Drives:
The Powerful Peripherals

Tom Netsel, Assistant Features Editor

Hitching a hard disk drive to a 64 or 128 may not be for everyone. But power users who need massive storage capacity and programs that load in an instant say a hard drive is worth its weight in floppies.

Hard disk drives are the powerhouses of data storage devices. When it comes to managing massive amounts of data in a hurry, nothing compares to a unit whose storage capacity is measured in megabytes. That's *millions* of bytes worth of information. In addition to having large storage capacity, a hard disk



drive is also fast—it can load programs almost instantaneously.

This speed and power is not inexpensive, at least not yet, and not everyone can justify the cost of adding a hard disk to his or her 64 or 128 system. But anyone who has ever waded through a stack of floppies trying to find one specific program can appreciate the convenience of a hard disk drive. So can the person who has to swap disks half a dozen times to complete one computer chore. But buying a hard drive is another matter. Your particular budget and computing needs will determine whether a hard drive is for you or not.

Who Needs One?

Right now, most individuals buying hard drives for their 64 or 128 use them to run electronic bulletin boards. Software developers are another group of people buying hard drives. Business and professional people use hard drives to handle inventory, accounts payable

and receivable, payroll, and other data-intensive chores necessary in running a business. In the business world, the bottom line can easily justify the cost of a hard disk system.

There are only a few manufacturers making hard disk systems for the 64 or 128. Prices still are not cheap, but they have dropped from the $1,500 range they were in just a couple of years ago. (See "Why Do Big Blue's Cost Less?")

The Lt. Kernal (Xetec, 2804 Arnold Road, Salina, Kansas 67401) is a 20-megabyte drive that sells for $899.95 for the 64 version, and $949.95 for the 128 model. The drive includes a set of commands that upgrade the 64's BASIC. The 128 drive requires the installation of an additional adapter board inside the computer. For 1571 burst compatibility, a computer modification is required, but all necessary instructions are included in the current versions of the technical manual.

JCT (P.O. Box 286, Grants Pass, Oregon 97526) has two hard drives for the 64 and 128. The JCT-1005 is a 5-megabyte drive selling for $495. The JCT-1010 is a 10-megabyte system with a suggested retail price of $595. Both drives work with either the 64 or the 128. They support all DOS and wedge commands and are compatible with the *GEOS* operating system. The drives come with a built-in floppy drive.

What Do I Get for My Money?

A hard disk drive is probably the dullest-looking peripheral you could add to your 64 or 128. You won't be impressed looking at one on your dealer's shelf. Typically, it's an enclosed metal box that has one or two small indicator lights, a power cord, and an interface to connect it to the computer. There are no fancy lights to watch, no buttons to push, no musical sounds to entertain you—but it's hard to imagine a device that expands a computer's capabilities as dramatically.

There isn't much to see on the outside because hard disk drives are sealed to keep dirt, dust, and even cigarette smoke away from the interior. The disk itself is about the same size as a floppy, but the 5¼-inch coated aluminum platter rotates at a much higher speed. A floppy spins at 300 revolutions per minute, while a hard disk drive gallops along at 3600 rpm. The top and bottom surfaces of the disk each have a read/write head that is considerably smaller than the heads in a floppy drive. Each side of the disk can store about 5 megabytes of information. Therefore, a 20-megabyte drive, such as Xetec's Lt. Kernal, has two disks sealed inside its outer cabinet.

Unlike the read/write heads of a 1541 or 1571, the heads on a hard drive do not actually touch the disk's magnetic oxide coating. Instead, they float a few millionths of an inch above the surface of the spinning disk. This close tolerance is why the systems are sealed. A speck of dirt or even a particle of smoke that wedges itself between the head and disk could cause irreparable damage to the head or disk surface, ruining any data stored there.

A 20-megabyte hard disk drive can hold the equivalent of 118 1541 floppy disks, or approximately 15,340 pages of text.

Handle with Care

Improvements over the past couple of years have made the drives less susceptible to head crashes that can destroy data, but they still should be handled with care. If you physically move a drive from one place to another, the heads should first be *parked* in a safe position. Most drives have a special command to do this. If you have children or pets in the house who are liable to jostle the drive even when it's off, park the heads while you are away.

The JCT drives have a load arm that reportedly protects the heads from crashing, especially while the drives are being moved. The heads are automatically protected and no special park command is necessary. "It's the only drive that you can fill up in any state of the union and then ship to Sydney, Australia," says JCT vice president Eddie Cate. "Bring it back, plug it in, and you won't lose any data."

The read/write heads are also much smaller than those found on a floppy drive. These smaller heads and faster drive speeds are what account for the system's tremendous storage capacity. While the diameter of a hard disk is the same as that of a floppy, the hard disk system packs data into a much smaller area.

How Much Data?

A 1541 stores about 170 kilobytes of data on a floppy disk. That's the equivalent of 130 pages of double-spaced typewritten text. In comparison, a 20-megabyte hard disk drive can hold the equivalent of 118 1541 floppy disks, or approximately 15,340 pages of text. If you stacked those same 118 disks on top of each other, you'd have a pile almost 15 inches tall. That's a lot of data at your finger tips.

How Fast?

With all this storage capacity, how fast can a hard disk drive find a file or program? Then, once the data is located, how long does it take to transfer the data to the computer? Since the heads on a hard drive are so close to the disk's surface, they do not have to be lifted, moved, and lowered every time they change positions. This cuts down on access time. While it usually takes a floppy disk drive about a second to locate data, a hard disk can find it in a few milliseconds.

Data transfer from the JCT is via the serial bus, and reportedly is 1.7~2 times faster than on the 1541. That's a modest gain in speed, but it still faces the serial bottleneck that has earned the 1541 a reputation for slowness. To truly demonstrate the advantage of a hard disk drive, data must be passed a byte at a time rather than a bit at a time. JCT offers this parallel mode of data transfer, which speeds up the process considerably. In parallel mode, the JCT transfers data at the rate of 32,000 bytes per second. The Lt. Kernal has a transfer rate of 38,000 bytes per second for the 64. That's reportedly fast enough to load a full screen of high-resolution color

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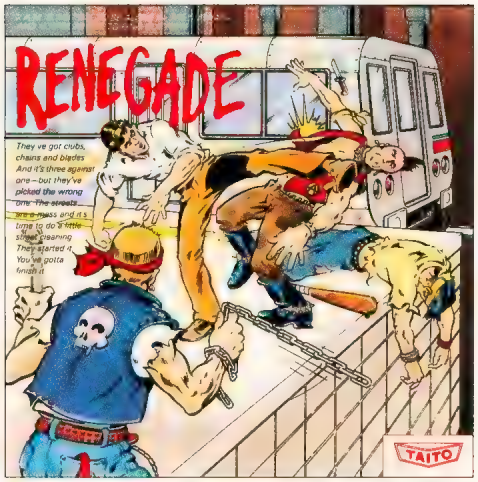

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Why Do Big Blue's Cost Less?

Affordability has always been a major selling point for hardware and software for the 64 and 128. This is especially true when comparing their prices against similar items developed for the IBM PC and compatibles. With a list price of $899.95, the Lt. Kernal hard drive has been described as a data storage device that uses a 64 as a plug-in accessory. When a drive costs five times as much as the computer it supports, it's hard to say which is the peripheral. But, if you can buy a 20-megabyte drive for an IBM for less than $300, why does one for the 64 or 128 cost three times that amount?

"The Commodore wasn't designed for a hard drive," explains John Shoultys, sales manager for Xetec, distributor of the Lt. Kernal hard disk drive. Commodore designers originally thought the cassette tape recorder would be the storage device everyone would use. To interface a hard drive with a 64 and get it to work at high speed require solving problems Big Blue and clones never had to face. It's not just a simple matter of plugging in additional hardware.

"You can go out and buy a drive for $200 and stick it in your IBM, and it'll probably run," Shoultys says. "The hard drive we sell has a built-in SCSI (Small Computer System Interface, pronounced *scuzzy*) card, a power supply, a fan, a line filter, and all the FCC-approved wiring and cabinetry to house it."

Shoultys says an interface is needed to get from the SCSI card on the drive to the computer, which does not have a SCSI port. That interface is a powerful little device that has ROM and memory built in, so it does not take any memory away from the 64 or 128. That speeds up the whole process, he says.

The 200K disk operating system (version 7.0) is built into the drive and is not sold separately, as MS-DOS is. You don't get an operating system with most hard drive kits, he says.

"When you combine all these things," Shoultys says, "you end up with an 18-pound package that gets shipped to the customer with a pretty comprehensive manual and a lot of other goodies that make this system work on these two computers. If you can take that $200 drive and make it work on your Commodore, more power to you . . . but it's not going to happen."

At JCT, where the ten-megabyte JCT-1010 lists for $595, and the five-megabyte JCT-1005 sells for $495, vice president Eddie Cate offers further explanation.

"Let's face it, the IBM and PCs have been out there for so many years that there's a lot of competition. It hasn't been too many years—less than five—that there's been a hard drive for the Commodore 64 and 128. It's basically a brand-new product, and nobody's really ventured into that marketplace."

graphics (about 11 kilobytes) in less than one second. The Lt. Kernal's transfer rate for the 128 is 65,000 bytes per second, or as much as 65 times faster than that of the 1541.

Where Is That File?

A hard drive can store a tremendous number of programs, find each one in less than a second, and load one into memory almost instantly. But if you can't locate the program you want, the whole process slows to a crawl. Imagine searching through a directory that holds the equivalent of 118 floppies. Managing the files on a hard disk system requires a little planning and learning a few new DOS commands.

Rather than making one large directory, you can divide hard disk systems into subdirectories. These subdirectories can themselves be subdivided. For example, you could have a directory called *Games* and another called *Productivity*. Under Games, you could have subdirectories for BASIC, Machine Language, Arcade, Adventure, and any other categories that would help you find a desired game. This may not seem too important at first, but it will as you add more and more programs to your drive.

The Productivity directory could be divided into areas containing Word Processing, Spreadsheet, and Database files. A directory called *School* could be subdivided to contain the notes for each of your classes. The idea is to divide the drive into logical directories that make it easy for you to find the program you want.

Extra Commands

Both the JCT drives and the Lt. Kernal use standard Commodore commands plus a number of special ones that facilitate the creation and use of subdirectories. The Lt. Kernal's DOS (version 7.0) has almost 50 enhanced system commands, including AUTOMOVE, a command that moves files from one subdirectory to another. CP/M commands have also been added to the latest versions of the Lt. Kernal's DOS to take advantage of the vast amount of CP/M software available for the 128.

Programs can be loaded into the computer's memory, saved to the hard disk, or copied directly from a floppy via a number of built-in copy commands. The biggest problem associated with using a hard drive comes from trying to install copy-protected software.

Backing Up Copy-Protected Software

An interesting command on the Lt. Kernal is one called *ICQUB*, (pronounced *ice cube*). ICQUB captures memory-resident programs in 64 mode and stores them on the hard drive. The program can then be called from the hard drive and started where it left off when it was saved. This is not meant to be a software-pirating feature. Programs saved with ICQUB can be run only from the hard drive. Copies saved to a floppy will not run. This feature permits users to back up copy-protected software and use it with the convenience of a hard disk. If a program returns to the floppy to look for specific modules, then ICQUB may not capture all of the program. If a program calls for a security key to be plugged into a joystick port, ICQUB will not elimi-

Lt. Kernal Battles the Bad Guys

When the prototype of the Lt. Kernal hard drive system was being refined, its designers at Fiscal Information came up with a rather interesting test. They gave an early version of the 20-megabyte hard drive to the police in Lakeland, Florida to help with the department's fingerprint analysis.

The department computerized a portion of its fingerprint files, using a Commodore 64 and a ComputerEyes video digitizer. Fingerprints were scanned with a video camera, digitized, and then stored on the Lt. Kernal prototype. Fiscal Information devised a program to record a person's fingerprints, along with that person's name, address, physical description, and mug shot. This information could be called up quickly on a monitor.

The police could digitize prints found at the scene of a burglary, for example, and then quickly compare them for identification with those stored on the drive. "You could do searches and comparisons," says Officer Joseph Salvadore of the department's Computer Applications Unit. "It would split the screen and put the suspect on one side and the print you were comparing it with on the other side. Instead of reading the print with an eyepiece off a card, you could actually read it off the screen."

Fingerprints are unique, but they can be grouped into several general classifications. After technicians lifted a print from the scene of a crime, it was digitized. The 64 scanned the digitized print and dropped it into a specific class. A fingerprint expert would then call up prints with similar criteria, looking for a match.

"He could bring up both prints, move them closer together, reverse the screens, look at them in reverse field—anything he wanted," Salvadore said.

The department tested the drive with the fingerprint analysis program for about four months, Salvadore said, but the software was never developed fully for permanent use. The hard drive, the 64, and the digitizer performed well, but converting the records and entering them into the computer was time consuming. The police department lacked the personnel to complete the necessary digitization.

"It was taking about seven seconds to digitize a print, and we had to digitize all ten fingers and store them," Salvadore said. "We have 25,000 fingerprint cards on file, so you're talking about a significant amount of time. But the system itself worked excellently."

nate that requirement. A company representative said there are no plans to make a version of ICQUB for the 128.

Several companies are producing software for the 64 and 128 that is hard disk–friendly. If the programs are not totally unprotected, then they at least have provisions for installation to a hard disk. Few, if any, of these are games; most are productivity-oriented. *Superbase*, Progressive Peripheral's popular and powerful database program, is being released for use on a hard disk drive. Owners of protected versions can purchase updates for a modest cost. Timeworks, Spinnaker, and Electronic Arts are other firms who offer unprotected word processors, spreadsheets, and databases. More and more firms are expected to offer products for hard disk drives.

Reliability

Compared to floppy drives, hard disk drives offer improved speed and storage capacity. Because of these advantages, once people use a hard disk system, most of them are reluctant to return to floppies. In addition to speed and storage capacity, the drives are reliable. The JCT series has a limited five-year warranty on the drive and a one-year warranty on all other hardware. The Lt. Kernal is covered by a limited one-year warranty. If you have warranty questions about your Lt. Kernal, Xetec offers a BBS at its Kansas headquarters. For technical questions, the drive's designers at Fiscal Information in Florida provide a BBS as well.

As with many electronic and electro-mechanical devices, the majority of failures usually occur during the first few days of operation. Many technicians recommend turning the drive on once you get it up and running, and then leaving it on for several weeks. If a drive is going to fail, most problems should occur during this period, while the warranty is in effect. A hard disk drive consumes less power than a 50-watt light bulb does, so it won't add much to your power bill.

Make Those Backups

Despite a drive's reliability, as with any other storage medium, it is important to back up important files. This can be tedious with large files, but imagine the problems if such files or programs were lost. Floppy disks are perhaps the most convenient way to back up files, but special tape drives have a higher storage capacity. Xetec offers a 40-megabyte streaming-tape drive that provides a fast means of backing up a whole hard disk.

As noted earlier, disk drives are still expensive accessories for a moderately priced 64 or 128. Xetec has been selling the Lt. Kernal for just over a year, and the price has stayed around the $900 mark. In the past year, JCT has lowered prices for the 1005 and 1010 by $100 and $200, respectively. There is talk of JCT offering a 20-megabyte drive. If one drive doesn't offer enough storage capacity, they all can be daisy-chained or expanded. As more 64 and 128 owners experience the speed and convenience of hard disk drives and begin buying them in greater numbers, we'll see lower price tags in the future.

When Commodore owners first saved programs on tape cassettes just a few years ago, it would have been difficult to imagine just how sophisticated data storage would become. While a hard disk drive may not be on everyone's shopping list this year, it goes to show how much power is available for 64 and 128 owners. It also reveals the fact that the 64 and 128 are still among the most versatile machines on the computer scene.

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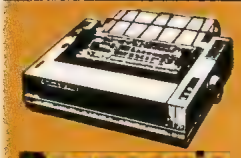

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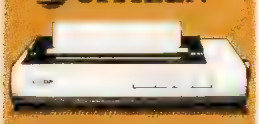

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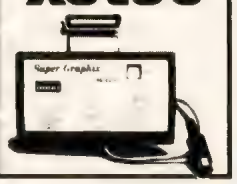

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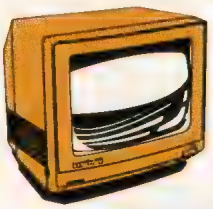

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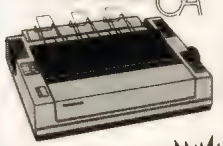

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The Civil War on Disk

Neil Randall

Six score and five years ago. . . .

On July 1, 1863, Heth met Buford near the small Pennsylvania town of Gettysburg. Heth's men wanted to find new shoes; Buford wanted to find the Confederate army.

Buford was more successful.

Within hours, reinforcements appeared for both sides. Soon, the bulk of Lee's Army of Northern Virginia was pushing back the bulk of Meade's Army of the Potomac. Two days later, Lee and his men were in full retreat. It was to be the start of a retreat that, for the Confederate States of America, would last for almost two years.

As world history goes, 125 years is a very short time. But for North America, which counts history in decades rather than centuries, it is long enough. In the 125 years since the Battle of Gettysburg, the American Civil War has continued to gain historical significance, not just for the United States but for much of the western world. For one thing, along with the American Revolution, it was one of only two truly important wars ever fought in the New World. For another, it really did affect global destiny.

It did one other thing as well. It captured the imagination of storytellers and historians. And, through the historians, it captured the imagination of designers of historical games.

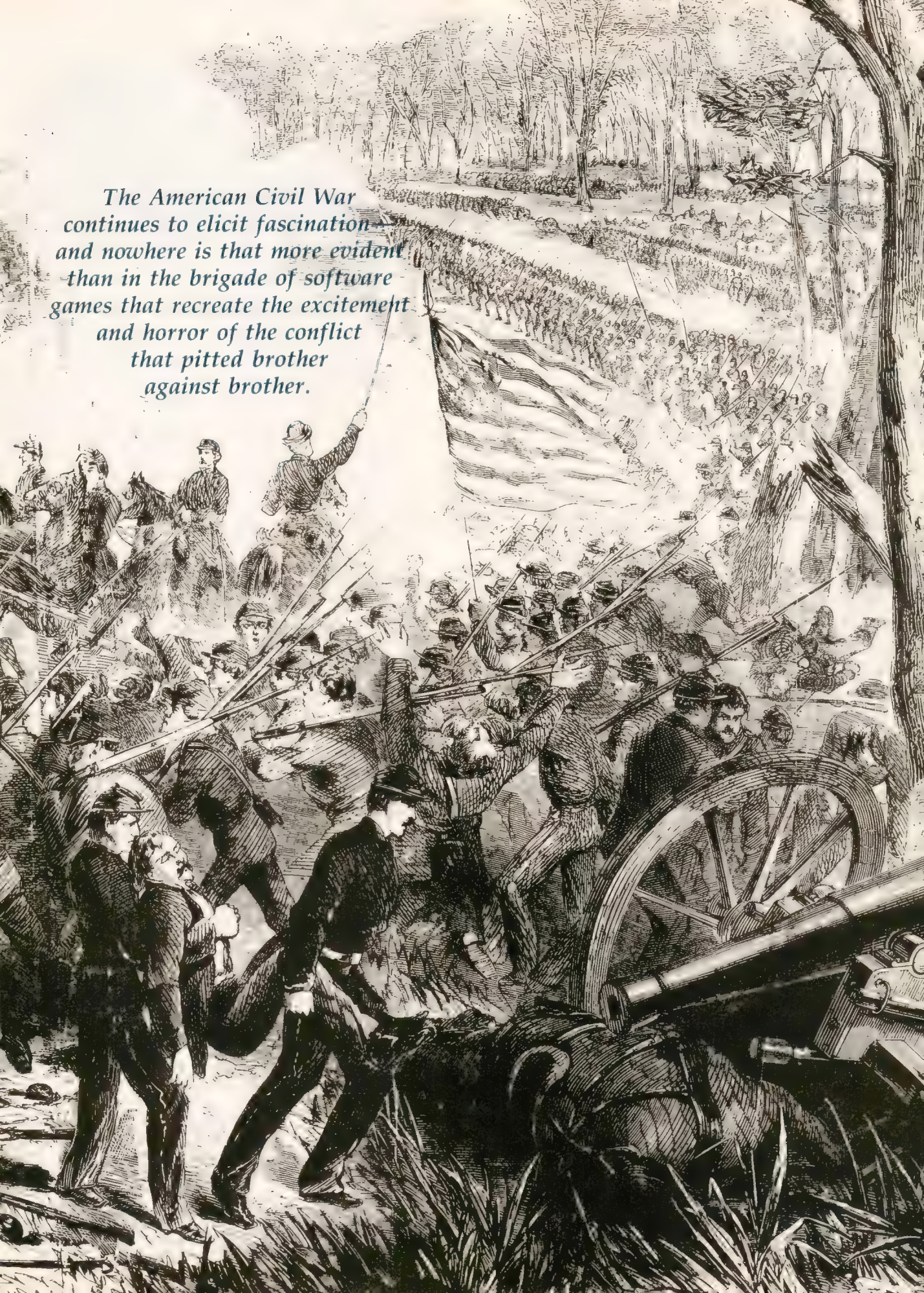
The Games Arrive

Over its 30-year life span, the war-gaming hobby has seen a plethora of games based on the Civil War. One of the first of all war games was Milton Bradley's *Battle Cry*, and one of the offerings of the fledgling Avalon Hill Game Company was the original *Gettysburg*. Since then, the hobby has seen games recreating almost all Civil War battles, from Antietam through Chickamauga to Wilson's Creek and Pea Ridge, with man-to-man battle games and strategic-scale theater games showing up as well. One Civil War game, SPI's *Terrible Swift Sword*, is arguably the best war game ever produced.

Strangely, though, computer games based on the Civil War were relatively slow in coming. Games of World War II and contemporary hypothetical warfare dominated the early 1980s. Not until comparatively recently has the Civil War surfaced on disk. Strategic Simulations Incorporated (SSI) leads the pack, quantitatively at least, on this topic as on pretty well all other war topics, but they aren't alone. At least one smaller company, Garde Games of Distinction, has produced a thoroughly notable game, and Australia's Strategic Studies Group (SSG) has released the first in a series of Civil War efforts. Suddenly, the Civil War gamer has a fair bit to choose from.

SSI's Civil War

SSI, unquestionably the hobby's war-gaming leader, offers three titles. *Gettysburg: The Turning Point*, *Antietam*, and *Rebel Charge at Chickamauga* all use the same gaming system. As with many SSI games, players can choose from among basic, intermediate, and advanced rules, with each set increasing the complexity, the playing time, and the gamer's sense of realism. The games emphasize both the movement of units and the problems of command, and the systems reflect this emphasis. Since *Rebel*



The American Civil War continues to elicit fascination and nowhere is that more evident than in the brigade of software games that recreate the excitement and horror of the conflict that pitted brother against brother.

Rebel Charge at Chickamauga

Blue Powder, Grey Smoke

Decisive Battles of the American Civil War, Volume One

Charge is the most recent, we'll let it stand here as an example of SSI's approach to the War Between the States.

On the whole, war gamers are served by the best manuals in the computer industry, and SSI's are at the top of the heap. Ten densely packed pages explain the rules of *Rebel Charge*, and these are followed by the Order of Battle, organization charts for both armies, an explanation of the computer's calculations, four pages of maps, and a six-page analysis of the historical battle. The manual is important to the understanding of the game, because without it, the relationship between leaders and units and the reasons for the results of movement and combat are lost.

The game is playable by one player against the computer, or by two human opponents. Setting up the game requires decisions about how difficult you want your job to be, and whether you want advanced rules and hidden units. Once started, the game runs through the various parts of the sequence of play, beginning with Command Control and ending with Victory Determination. In between are the vital parts, Reinforcements, Operations, and Combat.

The focus is on the player's ability to control the battle. Each unit is moved individually, and you must worry about such things as where the leaders are, what direction the units are facing, and how much ammunition your units are using. And all that is on top of worrying about what you have to do to win the game. In other words, there's a great deal to do, and a turn, on the whole, takes a considerable amount of time. War gamers, for the most part, are notoriously serious about their games, a fact that SSI fully recognizes.

En Garde

Just as serious are the designers at Garde Games of Distinction. The manual for *Blue Powder, Grey Smoke*, in fact, introduces the designers as "veterans of countless campaigns, late nights and not a few lost weekends." The manual then proceeds along the now standard war-game lines, with a quasi-legal numbering system (the rule for Skirmish formation is number 7.2.3), a discussion of the game's subsystems, notes on Civil War tactics, and a full explanation of the three scenarios. Unsurprisingly, the chosen scenarios are the big ones: Gettysburg, Antietam, and Chickamauga.

The Commodore 64 version of *Blue Powder, Grey Smoke* operates entirely with a joystick. At the bottom of the screen is a series of menus (actually, one menu with accessible submenus), and all the game's functions are controlled through them. There are three map levels, ranging from a depiction of the entire battlefield to detailed views of small portions of the battle. The game worries about the density of units, the posture of units (standing, kneeling, or lying down), formations, and firing by quad, file, or rank. In addition, *BPGS* offers 11 different types of terrain and differentiates among the seasons of the year.

The game's focus is on command, even though units are often individually controlled. As commander, you must issue orders to your troops in a simulated realtime environment. This is what makes *BPGS* unique. Rather than a series of game "phases," things keep happening until you press the button to give new orders. Then, with the Execute command, you start the battle rolling once more. The effect is quite convincingly that of a battle continually evolving, an effect both seemingly realistic and somewhat disorienting.

Blue Powder, Grey Smoke is challenging, feature-packed, and a little confusing. What it lacks in ease of play, though, it makes up for in sheer character. Players who take the time to learn its systems will find themselves drawn back to it again and again, even if playing is not always a satisfying experience. An unusual game, it's well worth examining.

The Australian View

The most recent addition to the Civil War library is SSG's *Decisive Battles of the American Civil War, Volume One*. SSG's focus has been primarily on World War II (even though designer Roger Keating made his name with SSI's *1985* series), but for well over a year they have been promising a strategic level Civil War effort. It hasn't surfaced yet, but the *Decisive Battles* series might ease the long wait.

The big news is the move away from the big three battles. *Decisive Battles, Volume One* simulates six engagements from the first half of the war, with six more to follow in *Volume Two*. Here are First Bull Run, Shiloh, Second Bull Run, Fredericksburg, and Chancellorsville. The sixth is Antietam once more, but the first five are the drawing cards.

SSG followers will recognize *Decisive Battles'* systems. The game is menu-driven, with a structure modified (considerably) from the company's popular *Battlefront* series. As in all SSG games, except the venerable *Reach for the Stars*, the menu IS the game, and learning your way around the menus is essential to learning how to play. Once the menus are mastered, players can concentrate on strategy.

SSG's trademark is its emphasis on the role played by the player. Here, you are in command, and you can even select a personal profile. Being cautious will minimize personal danger but do nothing to inspire the troops, while being heroic (the opposite end of the scale) will lift the troops to great heights and you, probably, to the heavens. This is an extremely nice touch, and it reflects the fact that the Civil War was in one sense the last of the personally led wars.

Beyond that, the game is easy to control. You give general orders to each brigade, telling them to move, fight, or rest, and the computer takes it from there. Unlike *Rebel Charge* or *Blue Powder, Decisive Battles* does not allow individual unit commands because the game requires you to adopt a specific role. In this way it's the opposite of *Rebel Charge*, while taking the menu interface of *BPGS* to a highly playable but sometimes frustrating level.

More to Come

There are other games, all with their own strengths and weaknesses. GDW's *Chickamauga* (distributed by Electronic Arts) offers great flexibility in rules, but it suffers somewhat in playability and interest. SSI's *Wargame Construction Set* includes a First Bull Run scenario, but it's limited by the game's need of standardized systems. Eagerly anticipated is Avalon Hill's *Civil War*, the adaptation of the superb board game from Victory Games. It was not available as of this writing.

What is apparent, even at this early stage in computer gaming, is that the Civil War is becoming increasingly well represented. Furthermore, the games themselves are very good. With this kind of start, and the fact that many aspects of the war have yet to be simulated, we can only assume that the future holds many fine offerings. On disk as in the history books, the American Civil War remains fully alive.

Blue Powder, Grey Smoke
Garde Games of Distinction
8 Bishop Ln.
Madison CT 06443

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San Mateo, CA 94404

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Wargame Construction Set
SSI
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Mountain View, CA 94043

Apollo 18: Mission to the Moon

Although I wish them well, there is a sadness in seeing former Apollo astronauts on TV, extolling the virtues of cold medicines. It comes from knowing there is no employment for their special skills since the Apollo series ended more than 15 years ago.

With the release of *Apollo 18* (the last real mission was number 17), Accolade makes it possible for those of us who remember the voyages into space to continue flying missions with a Commodore 64. Those too young to remember the original missions can learn of some of the excitement of the last of the great explorations—the manned missions to the moon.

I don't know what they teach about them in school these days—my own children know of the missions through their parents, through stories handed down like folk legends. But whatever is taught, *Apollo 18* will introduce you to history worth remembering: America's assault against the last frontier.

And yet it is not an accurate simulation. If compared to such classics as *Flight Simulator II* or *F-15 Strike Eagle*, *Apollo 18* would quickly go begging. In effect, nothing that can be stuffed into a 64K computer can duplicate the workings of the control panel and the numerous computers aboard real spacecraft.

Then again, this is not what Accolade attempted, making the failure a moot point. Rather, they have tried to simulate a mission—to take you from liftoff to splashdown, with at least a nod to every major routine along the way. In abandoning the impossible, they have created a mission simulator, as opposed to an Apollo simulator. They have broken the mission down into seven distinct parts—each with its own submissions—and have based the challenge upon timing and quick reflexes.

The look and feel of a real mission are there for those who remember. You begin with a screen showing the interior of the Command Center. Ahead of you, at screen center is a large TV monitor, watched by those who labor at the desks. At the lower right are timing instruments; on the left is a trajectory map; and at low center is the event window, apprising you of the current task and the time left to liftoff.

A digitized voice tells you to go to the telemetry screen, where you make the necessary adjustments to ensure that all systems are "Go." Then flip back to Command Center and watch as the countdown progresses.

Your initial tasks will be to fire your rockets at precisely the right time, release the umbilical cables, and then separate the first stage. All events are accomplished by pressing the fire button at precisely the right instant. Time is measured in thousandths of a second, and an accumulated error of 148/1000 second or greater results in an aborted mission. During an abort, you must fire escape-tower rockets, jettison fuel, and so on.

On the other hand, you may achieve orbit, in which case, you must again check all systems on the telemetry screen. If you are "Go," the rocket burns for translunar injection will be made by onboard computers. You'll then go to a sketchy control panel and perform the joystick maneuvers necessary to accomplish docking with the landing module.

These sketchy control panels are some of the elements that keep *Apollo 18* from being a true simulator: Each shows only the instruments necessary for the job at hand. This deficiency is somewhat alleviated by the telemetry screens, which are a shorthand way of indicating the many functions found in the onboard controls. Since it is a solution to an impossibility, it works well.

Other events encountered will be midcourse corrections, insertion into lunar orbit, landing on the moon, and retrieving pieces of Surveyor III (an actual mission of Apollo 12). After blast off from the moon and rendezvous with the command capsule, there are more midcourse corrections on the way home, EVA activity which includes deployment or retrieval of a satellite, and finally the reentry procedure.

Each broad category has a number of sub-missions designed to test your timing and reflexes in new ways. These tests make it difficult to complete a mission on your first attempt but keep you coming back for more. Think of all the aborted missions as simulator training that gets you ready for the real thing, where all your newly acquired skills

must come together and function perfectly. (It worked for the real astronauts.)

As each major event is accomplished, you'll be treated to a graphics screen that shows the earth and the moon, with a point of light between the two indicating your craft's progress. If you survive reentry (which even the badly crippled Apollo 13 managed), you'll see your capsule descending under parachutes and be told whether you landed at the correct spot.

As we've come to expect from Accolade, graphics and sound are as good as any seen and better than most. The digitized voice of Mission Control adds to the total experience. When you watch your rocket lift off, roll, and go through stage separations, you are watching what many of us were privileged to see on live television. It is an experience worth reliving.

I think the one weak spot is the documentation. All the information you need seems to be there, but the organization reminds me of a breathless person with much to say and too little time to say it. Plan to spend some time with the booklet.

At the end of the game—or at the end of any event—you'll be presented with a score card. Each mission and sub-mission event has its own score, and these numbers are then averaged for a final score. As you'll see when you boot up the game, all the real Apollo astronauts are credited with a perfect score of 25, and that's the mark for which you'll want to shoot.

But don't get the idea that it's going to be easy. Nothing worth doing ever is.

—Ervin Bobo

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Warp Speed

The accelerator cartridge war continues! One of the latest and most impressive entries is Warp Speed from Cinemaware, a company famous for its interactive software movies.

The utility cartridge market is crowded and competitive, so any new entry must have its own unique strengths. Warp Speed does. It's almost totally compatible with FastLoad, the original turbo-loader from Epyx that has been the leader for years. Of course, it does a lot more than FastLoad, and it works both on the 64 and the 128 (in native mode). In this last respect it is, to my knowledge, unique.

Warp Speed loads, saves, verifies, copies, and formats at turbo speed (disk only). Scratch and validate are done, unfortunately, at a slow speed. Fast-loading time is comparable to other cartridges (including FastLoad), and saving is quicker than most. The DOS wedge, as well as main menu, follows the FastLoad format. The short-hand for the save command (the back-arrow key) seems to be more dependable and bug-free.

Many FastLoad commands are unchanged. The directory is accessed by typing $. The first program on disk is loaded by pressing the Commodore-RUN key combination. Loading from the screen directory is even easier than FastLoad; just type / or % and press RETURN (no need to blank out the remaining "block-size" digits).

The cartridge works identically on the 64 and the 128; a small switch selects the desired mode. On the 64, choosing the 128 position disables the cartridge—a handy feature. There is a reset button as well. With this, together with a welcome UNNEW command (↑U), you can recover a BASIC program after a system crash. (This is possible on the 64 even with the cartridge disabled; just switch to the 64 position, reset, and type ↑U.)

A KILL command (↑K) is available to disable the accelerator if and when necessary. On the 128, Warp Speed set to 64 will automatically place the computer in 64 mode—another simple yet useful feature.

The cartridge market is crowded, but Warp Speed has its own unique strengths—and it works both on the 64 and 128.

Particularly elegant are the copy and scratch submenus—copying and scratching at their "user-friendliest." Both are very flexible. There are both dual (two-drive, fast, nibble-type) and single (fully verified) copiers. Since Warp Speed compresses data, complete disk copies—using the single copier—are made in from one to three disk swaps. This takes less than three minutes. In general, copying on the 64 takes more swaps than the 128 (but still no more than three), though the load/save speed seems to be the same. I should also mention that Warp Speed always saves in a format ("skew 6") that subsequently permits somewhat faster loading.

According to the satisfactory, if not copious documentation, Warp Speed accommodates the 1541, 1571, 1581, and "most compatible disk drives," including various hard drives, and the MSD dual drive. (The cartridge supports single and dual-drive systems, single or double-sided modes, and flexible renumbering of drives.)

Another significant feature offered by Warp Speed is the well-integrated disk sector editor and ML monitor. You go from one to the other and back again *directly*. Both have features you expect in today's better software. The sector editor in particular includes some that make it a delight to use, including a direct text-entry mode and commands that make it possible to load successive sectors of a file without typing in track and sector numbers.

Also unique is the TYPE command, which lists any text file to the screen, sector by sector, without corrupting memory. This works well with Warp Speed's ability to dump any text screen to a printer.

Type ↑$ for an auto-run disk menu with a highlighted directory that allows single-key load/run of selected files. This is a mixed blessing—not only does it take longer to access the directory this way, but the directory overwrites memory. It would seem a simple matter to have allowed the Commodore-RUN key combination to execute any program from the usual onscreen directory (which doesn't corrupt memory); at least one competing cartridge does this. This simple change would eliminate the need for a separate auto-run menu.

There are two features, contained on several competing cartridges, that I miss on Warp Speed: a set of Aid utilities (Delete, Merge, Renumber, and so on), and programmed or reprogrammable function keys. Of course, readily reprogrammable function keys might require the addition of RAM to Warp Speed (which it lacks). Perhaps this is asking too much of a 16K ROM cartridge. As the programmers profess, "We have taken 32K of machine language code and have rewritten it over and over until we could fit it inside a 16K ROM (to keep your cost down)."

This brings me to a final observation: $49.95 seems a bit steep for even an excellent 16K ROM cartridge. Several competing cartridges offer 32K ROM for only $5 to $10 more, and one even includes 8K RAM.

That wish list notwithstanding, Warp Speed is a fine cartridge. If you want FastLoad compatibility and an accelerator cartridge that works in both 64 and 128 mode, choose Warp Speed.

—*Art Hunkins*

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Merlin 128

I must in all honesty begin by saying that *Merlin 64* is one of only two pieces of software that inspired me to write a fan letter.

As a result, one of my principal reasons for wanting to review the *Merlin 128* assembler was to see how the designers could possibly improve on the original package. In case you're not familiar with it, *Merlin 64* is a fast and friendly assembler for the 64. It's even a little slick (an adjective rarely applicable to professional-level 64 programs).

Merlin 64 has line numbers like a BASIC program. *Merlin 128* also has line numbers that appear when the source code is listed, but only the current line number is visible in edit mode, in the upper right corner of the screen. I miss the line numbers. They made a nice transition from BASIC, even though they were not usable as labels. (If I had a subroutine that began at line 2000, I would still have to insert a label on that line to which the JSR could jump.)

I also miss the 40-column screen. *Merlin 128* runs only on the 80-column screen (if you boot while in 40-column mode, you are given a message to switch). You might think that using an 80-column screen would allow you to have longer comments, but this is not the case. You can have only about 70 columns of comment, about the same number as with *Merlin 64* (although long comments in *Merlin 64* wrap).

I believe most users would prefer a substantial comment field, perhaps 160 columns. I rarely use the comment field, but as far as I'm concerned, as long as I'm free to write something when the spirit moves me, I'm happy.

Merlin 128 *is a powerful assembler that comes on a 1571-formatted disk packed to within an inch of its life.*

Merlin 128 features many demonstration programs and macros on its 1571-formatted disk. In fact, it's packed to within an inch of its life. If you have a 1581 drive, my advice is to copy all the files immediately onto a 3½-inch work disk so you have a little breathing room. Roger Wagner Publishing has generously provided an unprotected disk. Reward this considerate company by guarding your copies with your life. Don't allow anyone to "borrow" a copy.

Like *Merlin 64*, *Merlin 128* is a macro assembler. That means that you can build up your own libraries of simulated instructions. Unfortunately, as with *Merlin 64*, you're left to your own devices when it comes to using the macros provided on the disk. The assembler itself is very friendly, but the documentation hasn't improved. It's virtually indistinguishable from the 64 version—very thin and spare. *Merlin 128* also comes with Sourceror, a powerful and fast disassembler that can be downright user-rude. For instance, the help screen tells you to enter the beginning address of the disassembly as $80001 if your code begins at $8000. This will generate an error message. You have to enter 8000l—don't ask how long it took me to figure that out. But this is entirely in keeping with Sourceror 64, with which I have to spend half an hour to relearn each time I use it.

The Sourceror 128 help screen is bigger than the 64's, and there are additional features. Disassembly of a 4K program takes only a few minutes.

Merlin 128, like its predecessor, allows you to assemble to and from disk, saving time and memory, and it supports conditional assembly. It goes beyond the 64 version by converting integers to floating-point and by providing a linker that can generate relocated code (useful with the 128's varying BASIC text storage area).

Merlin 128's biggest improvement

over *Merlin 64* by far, however, is its ability to scroll in two directions in edit mode. Nothing is so tiresome as listing a section again and again, trying to find the beginning of a routine or the crucial constant list that always seems to hover just inches above the visible screen. Scrolling backward through a file is a dizzying experience, and not all that common even on assemblers for more sophisticated machines, I am told. You can cursor up and down through the file, or you can use the cursor keys in combinaton with the Commodore key to move up and down by "pages" (a *page* is generally understood to mean a screenful of material).

Merlin 128 allows about 35K of source code in memory at one time (enough to generate about 8K of object code, if you don't use too many comments) before you have to concern yourself with disk assembly and include files.

Using the 80-column screen and the 1581 disk drive results in real 8502 processing speeds. I assembled a 77-block source file to get a sense of the program's speed. *Merlin 128* loaded in just 5 seconds. It loaded the source code in 5 seconds. It assembled the 19K source into a 4K machine language program in 13 seconds and then saved the object code to disk in 9 seconds. This should help me in my weight-loss plan. *Merlin 64* was always considerate enough to let me eat while it performed its various functions; now I have barely enough time to take a sip of coffee.

If you have a 1581 drive, I must warn you that the operating system may have a few remaining bugs. At least one person has discovered a scrambled directory after renaming a file. My own testing revealed a disturbing tendency to "lose" source code. Admittedly, this happens less often with *Merlin 128* than with *Merlin 64*. In an informal test, I discovered that it failed to save the source code between 1.5 and 20 percent of the attempts. In one test, two out of 40 test saves were crossed (that is, one file was misdirected to blocks containing another file). My advice is to treat the 1581 as if it were a small hard disk. Keep your application files (like *Merlin 128*, *SpeedScript*, and so on) on your 3½-inch disk and use your 5¼-inch disk to save your source code, text files, and data files. Like some hard disks, the 1581 has terrific capacity and speed, but less than terrific reliability.

I knew from the outset that *Merlin 128* would be better than *Merlin 64*. My main question was whether *Merlin 128* was improved enough to win me over from my previous practice of writing and assembling 128 programs in 64 mode and toggling between the two computers using the reset switch. It is. *Merlin 128* is a superior assembler for what arguably is the most advanced 8-bit computer that will ever be manufactured. If you are interested in 128 machine language programming (from what I have read, there is a dearth of 128-specific software), you should seriously consider *Merlin 128*.

—Robert Bixby

Merlin 128
Roger Wagner Publishing
1050 Pioneer Way
Suite P
El Cajon, CA 92020
$69.95

The Train

When I set out to explain *The Train*, a new game by Accolade, to my wife, it was easiest to say that the train in question held the finest art treasures of Nazi-occupied France, and that Burt Lancaster and a band of French resistance fighters had to steal the train and take it behind Allied lines. That pretty well sums up both the computer game and the motion picture, but in the game, Burt Lancaster isn't there to help you. You and Le Duc, a resistance fighter, have to do it yourselves.

If that sounds simple, remember that the Allied lines can be reached only by crossing miles of Nazi-occupied territory. Also remember that the Nazis have their hearts set on taking these treasures to Berlin, where they may be held to ransom a negotiated settlement to World War II.

You see the bullets walking through the dirt toward you in the best Hollywood tradition.

Before you can begin your race across France, you must capture the station where the train is waiting. With the perspective that has become a trademark of Accolade games, you see the action through the eyes of your character, in this case looking over the business end of a submachine gun. Your problem is to take out the Nazis you see behind the lighted windows, while the shadowy figure of Le Duc creeps into the station telegraph office.

Strangely, with the action under way, the game pauses and asks which level you'd like to play. Perhaps the idea is that, once you survive the first half-dozen Nazis, you are equipped to go on. At any rate, the bad guys are firing back, and you see their bullets walking through the dirt toward you in the best Hollywood tradition. Fail to duck (or accidentally shoot Le Duc), and the game is over.

After taking the station, you board the train. Before you lie controls for the throttle, brakes, steam blowoff, whistle, and so on. All the operating controls will be used during the course of your run. Keep your eyes on the gauges that show steam pressure and boiler temperature—you'll have to open the firebox so you can shovel in more coal from time to time.

As if this weren't enough, you're likely to receive a warning from Le Duc that enemy fighters are attacking. When this happens, switch your view to the front or rear of the train and hold off the attack with the guns mounted there.

Other messages tell you when you're nearing a bridge, a switch, or another station. These are the three other hazards you'll encounter. In the case of the switch, you must refer to the map to find out which way to go and then blow the whistle in a code that will tell the French resistance how you wish the switch to be set.

If you fail to stop at bridges, you'll be destroyed by the gunboats in the rivers. All stops must be precise. Warnings that a bridge or station is ahead will also include the distance to them in kilometers—these count down as you approach. Unless you stop at zero kilometers, you've bungled it (though at a station you can back up).

Once properly stopped on a bridge, the screen shifts and puts you in control of a cannon mounted in the center of the train. To survive, you must destroy the gunboats before they destroy you.

Train stations must be taken the same way that you took the first station: Fire at the Nazis (who are again shooting back) in the lighted windows, giving the shadowy Le Duc the necessary cover to get inside and capture the telegraph.

Pay close attention as you read the latest messages. They contain information about the track ahead and the progress of the war. After all, you need to know where the Allies are before you can deliver the train to them.

You can also use the telegraph to request specific help from the French underground. Ask them to take the next station or bridge, or ask for repairs. If a request can be granted, you'll be told what time the services will be in effect. Once back aboard the train, you can adjust your speed so as not to arrive too early. If a bridge can't be taken until 3:30, it won't do to arrive at 3:15.

Since scoring is based on how many guards you kill while taking a station and on how many gunboats you sink at a bridge, you'll want to use the underground sparingly to avoid rob-

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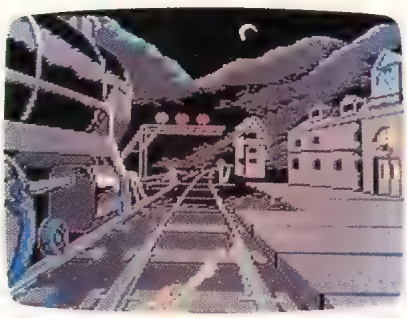
bing yourself of points. (The number of enemy fighter planes shot down also figures into your score—which is written to a high-score table on the disk.)

The elimination of planes, boats, and train stations requires the skills you've honed on arcade games. The difference here is that they are better suited to the story line than in games where the story is written only after the arcade sequences are done. For the rest of it, you'll learn how and when to control the train as you go along. Control is logical, such as using the steam blow-off when the steam pressure climbs too high. Such control soon becomes instinctive.



You control the train by joystick and a few easily memorized key commands for switching positions. All graphics are very well done, as are the numerous sound effects. I particularly like hearing the roar of the fire whenever the firebox door is opened—it shows someone was thinking of making the game complete.

In other simulations, such as *The Dam Busters* and *The Desert Fox*, Accolade provided in-depth background material on the times, weapons, and mission. That has not been done with *The Train*. Since my only prior knowledge of the mission is through the movie, I have no idea whether the event ever occured.

No matter. If it didn't happen, it should have, for this is the stuff of which myths are made. When I wrote the review of *The Dam Busters* almost two years ago, I expressed the hope that such history transformed into computer games would inspire other programmers to new games of varied richness. Apparently someone took heed, for *The Train* presents us with new challenges that should not be missed.

The Train should appeal to model railroaders who would rather be *inside* their toys, operating all the levers and switches. Certainly it will appeal to all of us who appreciate good computer craftsmanship.

— Ervin Bobo

The Train
Accolade
550 S. Winchester Blvd.
Cupertino, CA 95128
$29.95

Speed Buggy

At its heart, *Speed Buggy* from Data East is just a race game. And at its heart, the Mona Lisa is just a picture of a lady.

Well, maybe that comparison is a little high-flown. But *Speed Buggy* is actually superior to the Mona Lisa in many ways. First of all, it's more affordable. Also, coming in a rectangular box, it's stackable, a claim Leonardo couldn't make for his masterpiece. And finally, just try racing the Mona Lisa along five completely different tracks with the aid of a joystick. The guards at the Louvre would do a *pas de deux* on your pâté de foie gras.

What's unique about *Speed Buggy* is the junk littering the road. This junk is what makes the game interesting. You'll play it again and again, learning the choreography to avoid the pitfalls of rally racing. It's a matter of honing your reflexes and kinesthetic memory. In fact, if you're driving fast enough to win, the obstacles will appear much too fast for you to react.

You'll play Speed Buggy *again and again, learning the choreography to avoid the pitfalls.*

Actually, the *Speed Buggy* course isn't very different from the street I used to live on in Kalamazoo. The only real differences are that there aren't any potholes in the software and the drivers generally try to avoid running into things in *Speed Buggy*.

You will occasionally see another car, but it doesn't really play a part in the game, and it doesn't last long. Within seconds it crashes into a wall and bursts into flames, or falls into the lake.

Generally, as I said, you try to avoid running into things like boulders, gates, brick walls, and trees in order to avoid the delay of putting your car back on its wheels. In addition to avoiding the obstacles, you must also beat the clock. As you proceed through the game, you'll face more obstacles and have less time to take the course.

While avoiding hazards, try to run down flags and drive under banners to collect points. Time banners add extra seconds onto the next (not the current) leg of the race. Time banners are almost always behind trees or in front of rocks. You'll have to slow down, gaining time for the next leg at the expense of time in the current leg. The benefit is questionable, unless you are a much better driver than I am.

If you complete the leg in the allotted time, you'll be given a new time limit and bonus points.

The five different race courses represent open-ended courses located at the four points of the compass, plus a fifth looping course at an indeterminate location. The track in the north, for instance, has a background of snow and pines. The west is a desert. The courses differ primarily in their shape. It would have been interesting to have an icy northern course, for instance, or a dust storm in the west, complete with tumbleweeds, but the authors let this opportunity slip by.

You often will find yourself driving on two wheels. The manual suggests that this is a good way to squeeze through narrow openings between fences or boulders. I was not able to master this skill. You can also fly by running over a log. This happened to me once in real life, and I can attest to the game's realism of this maneuver. Unfortunately, you can't steer in the air (which is also realistic), and you're in danger of landing on top of something (which, thankfully, didn't happened to me).

Speed Buggy is a solid value and a true adrenaline-pumper. You'll work your joystick like a Charles Atlas dynamic-tension machine.

—Robert Bixby

Speed Buggy
Data East USA
470 Needles Dr.
San Jose, CA 95112
$29.95

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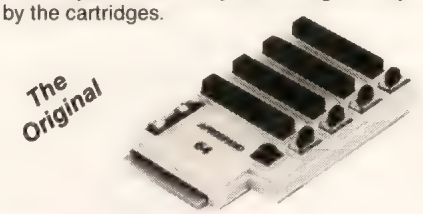

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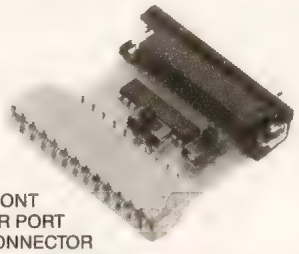

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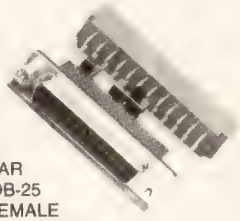

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Bagger

Kevin Black

This challenging arcade-style action game will keep you on your toes. You'll have to pass bags to customers, collect tips, and keep everything running smoothly at four counters to win. For the 64 with joystick.

A new sport has just been added to the Summer Olympics: bagging. Inspired by the millions of baggers in supermarkets across the country, the new event will test the skills of bag boys and girls around the world. You've been chosen to represent your country and bring back the bagging gold.

To succeed at the bagging challenge, you'll have to supply a steady stream of customers with bags of groceries and collect the tips they leave. This would be easy enough if there were only one counter, but in "Bagger" you have *four* to service.

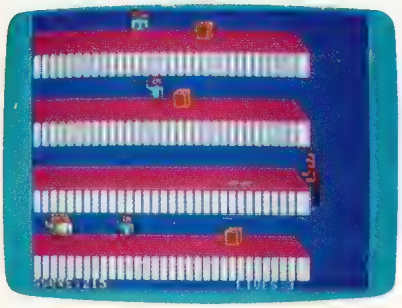
Getting Started

Since Bagger is written in machine language, you'll need to enter it with "MLX," the machine language entry program printed elsewhere in this issue. When you run MLX, you'll be asked for the starting and ending addresses of the data you'll be entering. Here are the values to use for Bagger:

Starting address: 0801
Ending address: 1828

Follow the MLX instructions carefully, and be sure to save a copy of the Bagger data before you leave MLX. After you've saved the data, plug your joystick into port 2 and then load and run Bagger just as you would any BASIC program.

When you first run the program, you'll see the moving title screen. To start playing, press RUN/STOP. You'll be notified of the starting level and immediately will be sent to the bagging arena. Here you'll see four tables with moving conveyor belts and two boxes at the bottom of the screen that display your score and number of lives remaining.



"Bagger needed for aisle two." Bag groceries and collect tips in this unusually busy supermarket.

Meeting the Challenge

You have two missions in Bagger: to supply each customer with a bag, making sure you don't hand out any extra packages, and to pick up any tips your customers leave. Customers appear at the left end of each counter and gradually move toward you. To send a bag down the table, press the joystick's fire button. To move from table to table, simply move the joystick forward or backward. All you have to do to pick up a tip is be at the end of the table when it arrives.

If you send one bag too many down a table, fail to get a bag to a customer, or fail to pick up your tip, you'll lose one of your lives. But don't worry, you have four lives in Bagger.

Satisfying all your customers and picking up all your tips means you progress to the next level. At each new level, there are more customers to supply with bags and more tips to collect.

Big Scores

Scoring in Bagger is simple. Each time a customer receives a bag, you earn 5 points. Every time you pick up a tip, you receive 20 points. And when you finish the current level, you earn 100 points.

To make playing the game easier, there are some helpful features in Bagger. First, to pause the game, press SHIFT. The game will stay paused as long as SHIFT is pressed. You can pause the game for a longer period with SHIFT/LOCK. Simply press the key to stop the game and press it again to restart. If you want to end the current game at any time, you can press RUN/STOP. To exit Bagger, reset your 64.

See program listing on page 70.

simple answers to common questions

Tom R. Halfhill

Each month, **COMPUTE!'s Gazette** *tackles some questions commonly asked by Commodore users. If you have a question you'd like to see answered here, send it to this column, c/o* **COMPUTE!'s Gazette,** *P.O. Box 5406, Greensboro, North Carolina 27403.*

Q. I bought a BASIC compiler for my Commodore 64 to make my programs run faster. Why is it that the compiled programs are so much larger than the uncompiled programs?

A. To answer this question, we'll have to briefly review what a BASIC compiler is and how it works.

Normally, when you run a BASIC program on a Commodore 64 or 128, you're using the computer's built-in BASIC *interpreter.* An interpreter takes each individual instruction in a program and translates it into the corresponding *machine language* instructions that the computer really understands.

When you run a BASIC program, the interpreter does its job—translating BASIC statements one at a time. Note that even a seemingly simple BASIC instruction such as PRINT may translate into a fairly large number of machine language instructions. Due to these two factors, BASIC interpreters run programs at a relatively slow speed.

Machine language programs, on the other hand, run at the computer's top speed. That's because the program is already written in the true language that the computer understands, so no interpretation or translation is necessary.

It would be great if all programs were written in machine language, but that just isn't practical. Machine language (a term that we use synonomously with *assembly language,* by the way) is more difficult to master than higher-level languages like BASIC, and machine language programs take longer to design, write, and debug. As with all labor-intensive tasks, sometimes the high quality of the results aren't judged to be worth the investment in time.

That's why *compilers* were invented. A compiler lets you write a program in a familiar high-level language like BASIC. When you have a debugged version of the program working, the compiler translates the program into machine language instructions.

Unlike an interpreter, however, a compiler does not carry out this translation "on the fly" as the program runs. Instead, it translates the BASIC instructions into machine language instructions just once, during a step known as *compilation.* The translated machine language instructions are then stored in a disk file that usually can be run like any other machine language program.

As you've noticed, though, this compiled program is much longer than the original BASIC program with which you started. It's also much longer than an equivalent program would be if written directly in machine language in the first place.

The main reason is that all of the machine instructions required to carry out a BASIC instruction such as PRINT must be included in the program when it's compiled. Every command you use in the BASIC program forces the compiler to add a whole series of machine language instructions to the final, compiled version.

In addition, the compiler must include many more instructions to handle such routine jobs as keeping track of variables, translating decimal numbers into binary, performing mathematical computations, and so forth. Most compilers automatically include all of the machine instructions for executing these functions whether they're actually used in the program or not. This is referred to as *overhead,* and it explains why even a one-line program compiles into a file several kilobytes long.

An interpreted BASIC program doesn't need to include this overhead because it's built into BASIC itself. The machine language instructions for PRINT and all other BASIC commands are permanently stored in the computer's read-only memory (ROM) chips. When the computer encounters a PRINT command in a BASIC program, the BASIC interpreter jumps to the appropriate machine instructions in ROM that print a character on the screen.

To put things into perspective, you could consider the BASIC interpreter in ROM as the "overhead" for an interpreted BASIC program. The BASIC interpreter in a Commodore 64 occupies 10K of ROM; when you add this to the length of an interpreter BASIC program, it's more in line with the length of an equivalent compiled BASIC program.

In case you're also wondering why even a compiled BASIC program runs more slowly than a similar program written directly in machine language, it's because today's compilers aren't nearly as efficient as the competent machine language programs. If you were to examine the compiled code (with a *disassembler*), you'd find numerous examples of sloppy programming.

Much more efficient compilers (known as *optimizing compilers*) are available for larger computers. These compilers analyze and improve the code that they produce, resulting in smaller and faster programs. Unfortunately, it will probably take several years for advanced optimizing techniques to "trickle down" to compilers made for home computers like your 64.

BASIC Geometry

Larry Cotton

Now that we've learned how to program the four BASIC math functions, let's find some ways to put our new abilities to practical use.

Geometry is a good start. Suppose you wanted to calculate the distance around certain figures, such as triangles, rectangles, squares, and circles. The distance around a plane (flat) figure is called the *perimeter*, except in the special case of the circle, where it's known as the *circumference*.

The accompanying illustrations show various geometric figures. As we write our programs, refer to these illustrations to see the logic behind the mathematic formulas we use.

Let's start with the triangle. We'll find its perimeter. Type in this program:

```
10 INPUT "LENGTH OF FIRST SIDE IN
   INCHES";X
20 INPUT "LENGTH OF SECOND SIDE
   IN INCHES";Y
30 INPUT "LENGTH OF THIRD SIDE
   IN INCHES";Z
40 P=X+Y+Z
50 PRINT
60 PRINT "THE PERIMETER OF THE
   TRIANGLE IS"
70 PRINT P"INCHES."
```

The three INPUT statements get the lengths of the three sides. Line 40 calculates the perimeter, line 50 prints a blank line, and line 60 prints the answer in sentence form.

Notice that the variable P in line 70 is not within the quotation marks. If it were, the letter *P* would be printed instead of the value that the variable P holds.

Suppose we want to calculate a rectangle's perimeter. Since there are four sides, but only two different lengths, we can use multiplication and addition:

```
10 INPUT "LENGTH OF RECTANGLE
   IN INCHES";L
20 INPUT "WIDTH OF RECTANGLE IN
   INCHES";W
30 P=2*L+2*W
40 PRINT
50 PRINT "THE PERIMETER OF THE
   RECTANGLE IS"
60 PRINT P"INCHES."
```

Last month we learned about My Dear Aunt Sally—the mnemonic phrase that reminds us that multiplication and division are performed before addition and subtraction. In line 30, variable L is multiplied by 2, W is multiplied by 2, and then the two results are added together and are assigned to the variable P. Note that line 30 could be replaced by this mathematical equivalent:

```
30 P=2*(L+W)
```

The parentheses keep My Dear Aunt Sally from multiplying L by 2 and then adding W. Parentheses are the only way to short-circuit My Dear Aunt Sally.

Here's a program to calculate the perimeter of a square. Since all four sides of a square are of equal length, we can simply multiply one side by 4.

```
10 INPUT "LENGTH OF SQUARE'S
   SIDE IN INCHES";S
20 P=4*S
30 PRINT
40 PRINT "THE PERIMETER OF THE
   SQUARE IS"
50 PRINT P"INCHES."
```

The Ever-Popular Pi

Calculating the value of circle's perimeter is a little trickier. We can envision a triangle's, a rectangle's, or a square's sides and logically arrive at the correct mathematical operations to total their lengths. But for a circle we'll need this formula:

Circumference = π × Diameter

Pi (or π) is a constant used in problems which involve circles. You can see the value of pi by entering this line and pressing RETURN:

```
PRINTπ
```

This never-ending decimal number is a subject unto itself, so for now, just think of pi as the constant 3.14. The diameter of a circle is its width through the center. Enter this program:

```
10 INPUT "CIRCLE'S DIAMETER IN
   INCHES";D
20 C=π*D
30 PRINT
40 PRINT "THE CIRCLE'S CIRCUM
   FERENCE IS"C"INCHES."
```

Your answer will be about nine digits long with a decimal. For this month, let's leave it that way; we'll save rounding—the shortening of a number to fewer decimal places—for next month.

Calculating Areas

The areas of plane figures are expressed in square units, such as square inches. The simplest formula for calculating the area of a triangle uses the length of the triangle's base (B) and its height (H). Refer to the accompanying illustration. The formula is:

A = B × H / 2

Here's one possible program to calculate a triangle's area:

```
10 PRINT "ALL MEASUREMENTS ARE
   IN INCHES."
20 PRINT
30 INPUT "WHAT IS THE TRIANGLE'S
   HEIGHT";H
40 INPUT "WHAT IS THE TRIANGLE'S
   BASE";B
50 A=B*H/2
60 PRINT
70 PRINT "THE TRIANGLE'S AREA IS"
80 PRINT A"SQ. IN."
```

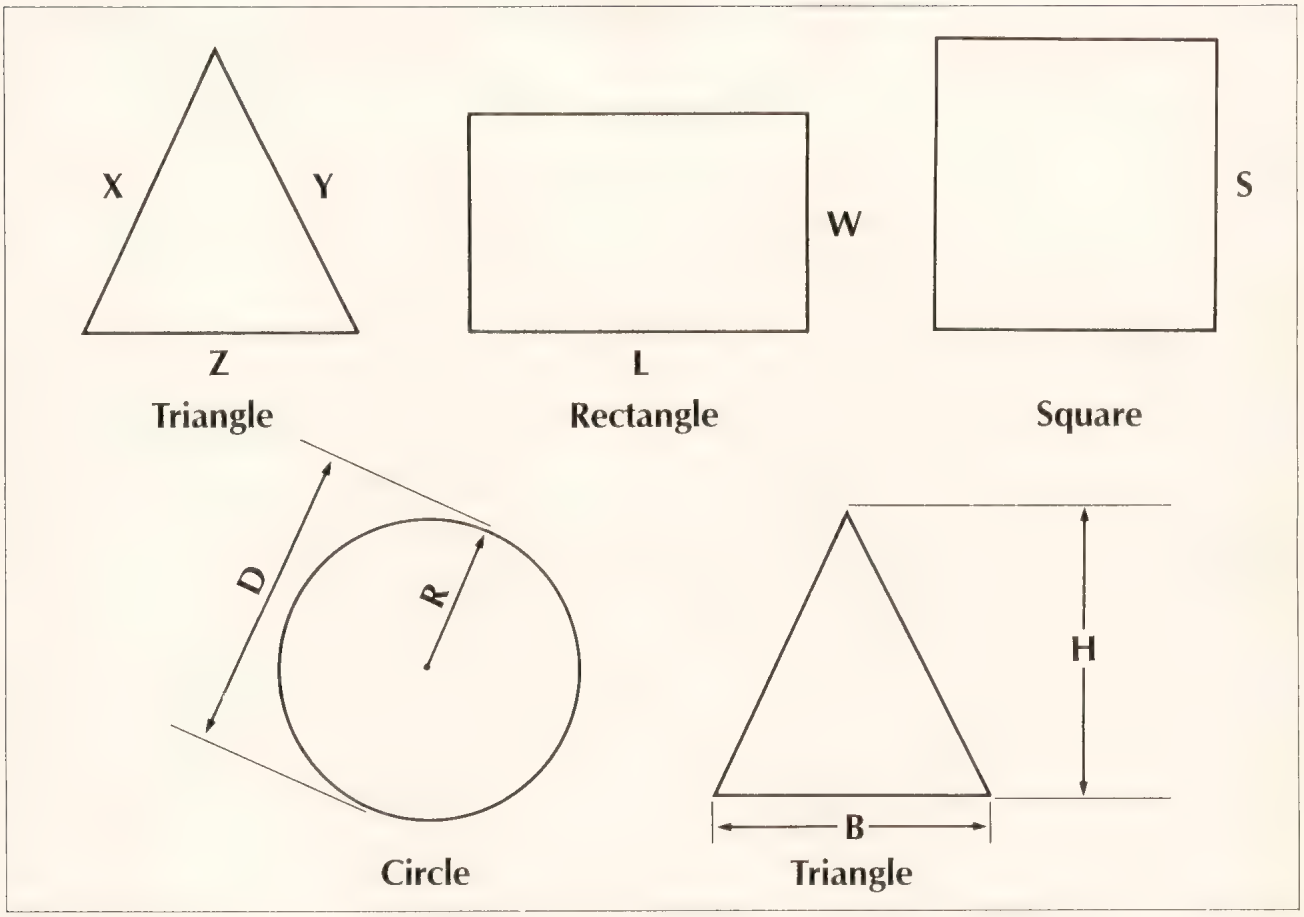
The other formulas for areas are somewhat easier. For a rectangle, one side is multiplied by the other:

A = L × W

The program:

```
10 INPUT "LENGTH OF RECTANGLE
   IN INCHES";L
20 INPUT "WIDTH OF RECTANGLE IN
   INCHES";W
30 A=L*W
40 PRINT
50 PRINT "THE AREA OF THE
   RECTANGLE IS"
60 PRINT A"SQ. IN."
```

Now we return to the square.



Now we return to the square. Here is one way it can be calculated:

```
10 INPUT "LENGTH OF SQUARE'S
   SIDE IN INCHES";S
20 A=S*S
30 PRINT
40 PRINT "SQUARE'S AREA IS"A"SQ.
   IN."
```

Numbers and Powers

Variable S times variable S can also be expressed as S^2, which is called "raising S to a power of two" or simply "S-squared." S^2 on a computer is entered by typing S^2. The ^ is (at least on Commodore computers) coincidentally on the same key that π is on. The 2 is the number of times S is multiplied by itself. Try this:

```
S=5:PRINT S^2
```

Enter this in the immediate mode and press RETURN. You should see 25. Try making S equal to other numbers. You always see the "square" of S (S multiplied by itself) as the answer.

The final exercise for this month will be to find the area of a circle. For this we need to know the circle's radius, which is half its diameter. The formula for a circle's area is

```
A = π × R^2
```

Here we use both π and ^. The formula in words is: The area equals pi times R-squared or simply pi R-square. We are multiplying π (the constant equal to about 3.14) times the radius multiplied by itself. Here's the program:

```
10 INPUT "CIRCLE'S DIAMETER IN
   INCHES";D
20 R=D/2:REM RADIUS IS HALF THE
   DIAMETER
30 A=π*R^2
40 PRINT
50 PRINT "THE CIRCLE'S AREA
   IS"A"SQ. IN."
```

My Dear Aunt Sally doesn't address raising numbers to a power. Numbers are raised to powers before any multiplication, division, addition, or subtraction takes place. If that were not true, line 30 would have to look like this:

```
30 A=π*(R^2)
```

The parentheses then would guarantee that the radius is multiplied by itself before the result is multiplied by pi.

That's our mathematical workout for this month. We should now be familiar with adding, subtracting, multiplying, dividing, using parentheses, and squaring numbers.

Don't be discouraged if all this has been a bit difficult to absorb in one sitting. As I've said before, the only way to learn anything well is to practice—so spend a little time playing with these exercises, entering various values at the input prompts. Next month we'll take a look at rounding.

The Intimate Machine

Fred D'Ignazio
Contributing Editor

A term that is growing in popularity these days is WYSIWYG (What You See Is What You Get). It refers to the way newer computer programs let you see your final output on the screen—just as it will look when you print it out.

This is an admirable trend. But think of its long-range implications. Futurist writers have already described advanced CAD/CAM (computer-aided design and manufacturing) systems installed in every person's basement which will fabricate new consumer products on demand. For example, if you want a new pair of shoes, just design them on your computer and "print" them out.

The concept of WYSIWYG has already reached an astounding stage in advanced laboratories. A newspaper recently reported on a new compact disc (CD ROM) drive in which the search time for the disk had been reduced dramatically by replacing the physical lens, which had to be moved mechanically, with a laser-simulated lens. Think of it. A real-world object—a lens—was created out of nothing but pure light. Something from nothing. WYSIWYG!

Multimedia Hackers

As computers become more intimate and personalized, the concept of WYSIWYG may extend to how we think about machines. When we look at a computer in the future, what will we see? What will we get?

I'm reading a great book which I recommend to anyone interested in personal computers of the future. It's called *The Media Lab*, and it was written by Stewart Brand, the author of *The Last Whole Earth Catalog*. (*The Media Lab*, from Viking Press, came out in late 1987, and should be out soon in paperback.) It describes the experiments underway at MIT's prestigious Media Lab by a group of ingenious, multimedia "hackers."

Much of the group's work falls under the heading "transmission of presence." Transmission of presence is reminiscent of Star Trek. However, since we don't have the Starship Enterprise's transporter to beam people from place to place, we have to figure out other ways to send people electronically to distant locations. One method is "talking heads." A TV signal of a person's face is beamed onto a plastic bust of a human's head. It's remarkable how lifelike the bust becomes with the TV picture superimposed onto its generic features—almost like having the person in the room with you.

Look into My Eyes

Another goal of MIT's researchers is to make technology more personal and more intimate. They have developed joysticks that fight back in a videogame; touch screens which let you "feel" data; cartoons with intelligent characters (sharks, skeletons, and worms); playful, cuddly robot blimps, chairs, and stuffed animals which interact with children; and computers that read lips and track eye movements so they can tell where you're looking on the screen.

Brand described an eerie experiment in which the intelligent character in a computer cartoon turned and faced him while he was staring at the computer screen. The character looked Brand directly in the eye. If this character had had the ability to gauge where Brand was looking, it would have known Brand was looking into its eyes.

Brand describes the experience as almost hypnotic and a little scary. The day is not far off when we'll come eye to eye with a computer. Will this be WYSIWYG? What will we see? What will we think we see?

You can get intimate with computers, but you can also use computers to get intimate with other people—perhaps unintentionally. If you ever want to get personal with a member of the opposite sex, just chat with them for a few minutes in computerese. Have you ever noticed how many computer buzzwords have a kind of TV dating game feeling about them? For example, *baud* describes the transmission rate of data from one computer to another, but it sounds to the average listener like you are describing the computer ("bod") as a hunk or a "number 10." Or else, even worse, it sounds as if you are talking about a computer with an off-color, risqué sense of humor (a computer "bawd").

And we chatter mindlessly about computers, printers, monitors, and so on, as being *compatible* or *incompatible*. Again, the computer dating game. Just think how this sounds to other people.

Careful with Those Semantics!

An example of this blindness to our own lingo happened recently when I made a presentation to elementary school teachers. I talked for an hour about mating male and female cables with lots of vivid examples of plugging cables together.

Suddenly I noticed the blushes on several teachers' faces, and I realized how I sounded. Mating incompatible machines using male and female connectors so they'll share the same baud sounds more like a talk on sex education than a lecture on high tech.

To all you computer jocks out there, my advice is, when talking to noncomputerists, mind your manners and watch what you say. You may think you're talking high tech, but to your audience you sound like Dr. Ruth.

Viral Infections

Todd Heimarck
Contributing Editor

A biological virus is a germ that enters your system, replicates, and makes you sick. An influenza virus gives you the flu, for example. Before you're actually ill, you may not know that you've got a bug; you might unwittingly spread it to others.

A computer virus acts similarly. It's a program that gets into a computer, spreads contagiously by making copies of itself (usually before anyone guesses that the computer has been infected), and eventually does something nasty.

One of the first examples of a computer virus is a key element in the book *Shockwave Rider* by John Brunner. Written before the advent of personal computers, the book presents a society that uses a huge supercomputer hooked up to millions of dumb terminals located around the country. (A dumb terminal isn't a real computer. It only works if it's connected to a remote computer—sort of like having a 64 that only works in conjunction with QuantumLink.)

The hero of the novel is a genius who controls his very own computer virus. Whenever he wants to change his identity, he activates the program. It creates the new identity and erases all records of the old one.

Trojan Horses

Viruses are sometimes called *Trojan Horses* because computer users willingly invite them into their computers only to find something unpleasant inside.

The contagious program may be downloaded from a bulletin board system, borrowed from a friend, or obtained at a user group meeting. Perhaps it prints a calendar, calculates mortgage payments, or plays tic-tac-toe. On the surface, it looks like an innocent program. But it contains an active virus.

When you exit the original program, the virus remains in memory. Without resetting your computer, you continue using it. At some point, you look at a directory or load or save a file. During disk access, the virus checks the disk's boot sector for a copy of itself. If it's not there, the virus copies itself to the disk. If the virus does exist on disk, it might decrement a counter. Whenever you boot from that disk in the future, the virus copies itself into memory. If you switch disks, the virus spreads.

There's more. The virus's internal counter counts down until it hits 0. It might wait for 10 or 250 disk accesses before going into action. At that point, it formats the disk in the drive or scrambles your data files. The screen then flashes a message like *Ha Ha. Gotcha.*

The 64's Natural Immunity

Most computers load the disk operating system (DOS) into memory from a disk. A DOS is a program that knows how to move around the disk, reading or writing disk sectors. It also protects sectors in use and frees them up when you scratch a program. It takes care of updating the directory, formatting disks, and other disk-oriented jobs.

If the disk-based DOS is later upgraded, you simply get a new boot disk. The DOS disk is the place where viruses live. To infect such a disk, all you need is a single program that puts the virus in the boot sector that loads DOS. The virus then copies itself to any other disks that might come along.

The 64 and 128 have their operating system in read only memory (ROM). The DOS is built into the disk drive. The disadvantage to this approach is clear: To upgrade, you must install replacement ROM chips.

But there's also an advantage: Viruses can't be installed on Commodore boot disks because the 64 doesn't use them. The DOS is already in the disk drive.

The 128 does make provision for booting from disk, but most 128 owners don't use boot disks for 64 or 128 mode.

It's possible to create a 128 virus, but it probably wouldn't spread very far.

Survival of the Fittest

Several years ago, *Scientific American* published an idea for a computer game called *Core Wars* (*core* is an old name for computer memory). The battlefield is a section of memory that wraps around from the highest byte to the lowest byte. The combatants include two or more computer programs that use a simple language, with instructions for branching, conditional branching, looping, math, copying a byte from one location to another, and so on. There is also a STOP command that halts a program.

The goal of the game is survival. You can pursue several interesting strategies. The all-out offensive program sprays STOPs throughout memory, attempting to hit the other program. Defensive tactics include building buffer zones of STOPs around the program's perimeters, and copying the program to another location and jumping there if the enemy gets too close.

You might discover that program A usually beats program B, but B beats C, and C beats A. You might attempt to write a program that adjusts its actions according to the opponent it's facing. However, the longer the program is, the more memory it uses, which makes it more vulnerable.

If you're interested in exploring viruses, don't write one that formats disks or scrambles data files. Instead, try inventing your own Core Wars language.

Super Printer Driver

Douglas M. Blakeley

This new printer driver for Epson, Star, and compatible dot-matrix printers offers near-laser-printer-quality printing with both GEOS and GEOS128. A customizer is also included to allow you to fine-tune the driver.

If you have an Epson or compatible printer and you use *GEOS* or *GEOS128*, this new printer driver can give you near-laser-printer-quality printouts with print densities of 60, 72, 80, 120, 144, or 240 dots per inch (depending on your printer's capabilities). The driver comes with preinstalled codes for Epson FX-85/86e, Epson LX80/86, and Star SG-10/15; it also has an option that allows you to customize the driver for other Epson-family printers as well.

The printer driver program comes in two parts. "Driver" (Program 1), is the machine code for the printer driver. "Customizer" (Program 2), tailors the driver to a specific printer and converts the driver to a *GEOS*-format file. Program 2 also permits you to select the printer device number (4 or 5) and disable the paper-out sensor to permit single-sheet printing with *Writer's Workshop*.

Getting Started

Since Driver is written in machine language, you'll need to enter it with "MLX," the machine language entry program printed elsewhere in this issue. When you run MLX, you'll be asked for the starting and ending addresses of the data you'll be entering. Here are the values to use for Driver:

Starting address: 7804
Ending address: 7F33

Follow the MLX instructions carefully, and be sure to save a copy of the Driver data with the filename PR.OBJ before you leave MLX.

Customizer is written in BASIC, so simply type it in, save a copy on the same disk as Driver, and type RUN. Customizer sets the top of BASIC memory to 30720 to provide a safe work area and then loads PR.OBJ into memory addresses 30720 to 32557. Please note that, although the driver you create with customizer can be used with either *GEOS* or *GEOS128*, you must customize the driver on the 64 (or a 128 in 64 mode).

When you run Customizer, it asks you for your printer type, printer address (4 or 5), and whether you want the paper sensor disabled. After these questions are answered, Customizer patches the Driver's object code in memory and saves the customized Driver to disk. This Driver is then converted to a *GEOS* format file. The filename EPSON FH-85, EPSON LH-80, or STAR SG-10 is used depending on the printer you specified. The PR.OBJ file is not destroyed in this process, so if you make a mistake, you can start over.

Once the file has been converted, treat the disk just like a *GEOS* disk. Don't use the standard disk validate command; use the *GEOS* validate command instead. As a reminder that the printer driver is multidensity, the file icon is modified to include the letter *M* in the upper left corner.

Using the Printer Driver

Once the conversion program has been run, load the *GEOS* operating system and transfer Driver to a *GEOS* work disk. If the disk containing the printer driver has not been used under *GEOS*, you'll be asked if you want the disk converted. You should answer *yes*, or you won't be able to transfer the file with a single disk drive.

The new printer driver can be activated by selecting the *GEOS* menu in the upper left corner of the screen and choosing the Select Printer option. After choosing to print a *geoWrite* or *geoPaint* document, a new dialog box will appear, allowing you to select the printer density. Choose the density you want by clicking once on the corresponding icon. The *F* icon selects the filled 240-dots-per-inch mode, while the 240 icon selects the enhanced mode.

Once the density has been chosen, the printer initializes to this format and prints your document. For those owning *Writer's Workshop*, the new driver's menu will appear after the initial print menu, which permits you to select starting and ending pages as well as high, draft, or NLQ modes. If draft or NLQ modes are selected, the second menu will still appear. In this case, select 80 dots per inch to continue printing.

When using printer densities of 72 and 144 dots per inch, *geoWrite* and *geoPaint* will make adjustments on the printed page width. *GeoWrite* will widen the text by two-thirds of an inch while maintaining the same number of characters per line as shown on the monitor, making up the difference by narrowing the margins. *GeoPaint* will not print the rightmost three-fourths of an inch of the graphic. For this reason, don't use this rightmost area when planning on using 72- or 144-dots-per-inch densities.

Customizing

For those with printers that are in the Epson or Gemini family but whose printer control codes differ, there is an option to customize your own printer driver. The use of this option requires careful consultation of your printer manual and should only be used once you understand the correct codes.

After this option is selected, you'll be asked for the codes to select certain features. For each question, the customizer will display the number of bytes it expects for that

code. The control codes should be entered as *decimal* values. If the control codes for your printer are less than the requested number of bytes, you must enter leading zeros. For example, if the code to select 244 dpi is ESC "z" (ASCII codes 27 and 90), you would enter 0, 27, 90 since three bytes are asked for. The customizer creates a file with the name CUSTOM.

If you create a custom driver and find extra white space between lines, you may need to recreate the custom driver and use 2/16-inch spacing instead of 8/72- inch spacing. To do this, use the codes ESC "3" 24 when asked for the three-byte 8/72-inch code. For those with IBM printers, or ones that use the IBM command set, you may need to use this code for another reason: The IBM printer's line spacing code requires five bytes instead of the three allotted in the driver program. Simply follow the directions above and use ESC "3" 24 when asked for line spacing.

Notes on the Densities

Printer densities of 72 and 144 dots per inch produce round circles on the printout since these printers also have vertical densities of 72 dots per inch. These densities tend to fill the printed page better, but there is a reduction in the width of the printed *geoPaint* document.

The 144 and 240 modes are best suited for use with the finer fonts such as BSW and University. These fonts use one pixel width for their letter structure and generally require a new ribbon to print cleanly. The 144 density will print these fonts with two very closely spaced dots which fill out the letters.

The 240-dots-per-inch mode is implemented as a two-pass driver, much like a dot-matrix printer's NLQ mode. Part of the letter structure is printed on each pass to make best use of the printer's capability. This is a slow driver, but it's worth the wait on final drafts.

See program listings on page 79.

COMING NEXT MONTH
Using the 1581 with *GEOS*

POWER BASIC

Quick Save

Buck Childress

Save your BASIC programs to disk with a single keystroke. For the Commodore 128, 64, Plus/4, and 16.

How many times have you lost the program you were working on because of some interruption? Maybe the telephone rings. You get up to answer it and return to find someone else sitting at your keyboard. Or perhaps an electrical storm causes a power outage in your neighborhood. Or you accidentally kick out the plug to the power supply. Regardless of the cause, you've lost everything. "Quick Save" offers a solution. It's designed to make saving as quick and easy as possible.

With Quick Save installed, you can save the current BASIC program to disk simply by pressing the English pound key (£). Versions are included for the Commodore 128, 64, and the Plus/4 and 16.

Using the Program

Quick Save is a BASIC loader—it contains a machine language program in the form of DATA statements. Type in the version for your computer using the "Automatic Proofreader" program found elsewhere in this issue. When you've finished typing, be sure to save a copy of the program to tape or disk. To begin, simply load the program and type RUN. The machine language program is POKEd into memory. Now, activate Quick Save by SYSing to the address given on the screen. On the 64, SYS 828; on the 128, SYS 2816; and on the Plus/4 or 16, SYS 818. (To disable Quick Save, SYS to it a second time.)

Whenever you want to save your BASIC program, cursor to a blank line; then press £ (located on the right side of the keyboard) and RETURN. It's that easy. Quick Save saves your BASIC program with the name FILE, followed by a number in the range 00–99. The first program saved has the filename FILE00. After saving, the file counter automatically increments. The next save uses FILE01, and so on. Should you save through FILE99, the file counter resets to 00.

Traps and Tips

To keep it short, Quick Save has no built-in error checking. If you try to save a program without a disk in the drive, Quick Save assumes the program successfully saved and updates the file counter. Similarly, if you reload Quick Save and attempt to use it a second time on the same disk, no saves occur until the file counter is past the highest number of the existing files. In these cases, the red error light on the disk drive should alert you to the problem.

If you need to, you can manually change the file number for the next save. For instance, suppose you want the next file to save as FILE15. To set the file counter to 15 (on the 64), you type

```
POKE928,ASC("1"):POKE929,ASC("5")
```

On the 128, type

```
POKE2929,ASC("1"):POKE2930,ASC("5")
```

And on the Plus/4 or 16, type

```
POKE920,ASC("1"):POKE921,ASC("5")
```

How It Works

Quick Save is just over 100 bytes of ML. When enabled, it redirects BASIC's error handler to point to itself. Whenever a BASIC error occurs, the program checks the input buffer for the English pound character. If this character is in the buffer, Quick Save takes over, saving the BASIC program to disk and incrementing the filename counter. Otherwise, the normal error-handler routine executes.

See program listings on page 72.

machine language programming

Simple Counting Loops

Jim Butterfield
Contributing Editor

One of the most basic elements of programming is the counting loop, which repeats a fixed number of times. Initially, a value is set to 0. Then, each time the loop is executed, the count is increased. Eventually, it reaches a maximum, and the program stops looping. Alternatively, the loop can "count down" to 0—but we'll discuss that later. For now, let's see how to set up a simple upward-counting loop.

We'll assume that the count is less than 256, so we may hold its value in a single byte of memory (or in a register). This simplifies two jobs—incrementing and testing to see if the count is within limits.

Custom Counters

The 6502 family of processors has two registers that are ideal for counting: X and Y. If either one is free, looping is relatively painless. Let's assume that we wish to call the PRINT routine (the Kernal CHROUT subroutine at $FFD2) exactly ten times. We'll start the program at $2000, (8192 in decimal—not the ideal place for machine language programs, but available in almost all Commodore computers). Here we go, with details on the programming:

```
2000 A9 2A      LDA #$2A
```

This is how you might see the program displayed by a machine language monitor using the disassembly option. In hexadecimal, 2000 is the address of this instruction. A9 and 2A are the two bytes making up the first instruction. These are also hexadecimal numbers; you might know them better as decimal 169 and 42. Next comes the instruction the way we like to see it: LDA (LoaD A), then the # sign (to tell us what follows is a value, not an address), and $2A for the value $2A (decimal 42). Decimal 42 is ASCII for an asterisk—this program will print ten asterisks.

When the computer goes to $2000 (the BASIC command SYS 8192 will do this), it executes this instruction, which causes it to load the value for an asterisk character ($2A) into the A register. After that, it goes on to the next address ($2002, decimal 8194) and looks for another instruction.

We're ready to count to 10. Let's use the X register to hold our count value:

```
2002 A2 00      LDX #$00
```

This tells us to load X (LDX) with the actual value (#) of 0 ($00). If you leave out the # sign, the computer will store the contents of memory location 0 in the X-register—not what we want. After this instruction, the computer has the code for an asterisk in the A register and the number 0 in X. Now we begin the body of the loop (the instruction or instructions that are executed each time through the loop).

```
2004 20 D2 FF JSR $FFD2
```

This instruction asks the computer to jump to a subroutine (JSR) at address $FFD2, a location in the computer's ROM chips that contains a routine that prints the character in the A register. This subroutine is known as CHROUT or BASOUT, and it's *always* located at $FFD2 in 8-bit Commodore computers. One more thing: This subroutine leaves the contents of the registers untouched.

We've done the deed . . . now let's count.

```
2007 E8         INX
```

INX stands for "increment X." From 0, it goes to 1. The next time around the loop, it goes to 2, and so on. If we were using Y as a counter, we would use INY.

```
2008 E0 0A      CPX #$0A
```

Compare X with the value $0A, which is 10 in decimal. Our counter is X, so we're testing to see if X has reached 10 yet. If not, we go back with this instruction:

```
200A D0 F8      BNE $2002
```

Branch if not equal (BNE) back to $2002. If X has not yet reached 10, we go back and do it again. When we do so, X advances another notch and we repeat the test. Eventually, X is 10 and we won't take the branch, we'll move on to the next instruction instead.

```
200C 60         RTS
```

RTS means return from the subroutine. The ten asterisks have been printed, and the machine language program is finished.

Options

Some programmers prefer to count downward. The program above could save two bytes and run ten microseconds faster if we did so. Personally, I don't need the two bytes or the ten microseconds, so I usually count upward. There is less chance of a mistake.

If the X and Y registers are in use, you'll have to store the counter in memory. Set it to 0 with instructions like LDA #$00:STA $C000 (provide an available memory location—$C000 is usually safe on the 64). Increment it directly in memory with the INC $C000 instruction. To test it, you'll probably load the value to a register.

High Counts

It takes more work to count above 255. Your counter will occupy two bytes (a high byte and a low byte). Setting this double counter to 0 is a snap—just store 0 in both bytes. Incrementing and comparing take more work, though.

If you go above a one-byte count, you'll often switch to a new type of looping system. Instead of a two-byte count, you'll make use of a two-byte address that points at data somewhere in memory. We'll discuss it next time.

If you've discovered a clever time-saving technique or a brief but effective programming shortcut, send it to "Hints & Tips," c/o COMPUTE!'s Gazette. If we use it, we'll pay you $35. We regret that, due to the volume of items submitted, we cannot reply individually to submissions.

64 Disk Defaulter

Arjun Nayyar

Are you tired of typing ,8 every time you access your disk drive? Here's a short program that changes the default device number from 1 (tape) to 8 (disk).

Type in the following listing and save a copy to disk. To use it, simply load and run. Now, anytime you load, save, or verify a program, the computer automatically accesses the disk drive, not the tape drive.

```
10 FOR J=679 TO 716:READ K:POK
     E J,K:CS=CS+K:NEXT
20 IF CS<>4119 THEN PRINT "**
     {SPACE}ERROR IN DATA ST
     ATEMENTS **":END
30 SYS 679
40 DATA 169,002,141,049,003,14
     1,051,003
50 DATA 169,186,141,048,003,16
     9,197,141
60 DATA 050,003,096,169,008,13
     3,186,169
70 DATA 000,133,010,076,165,24
     4,169,008
80 DATA 133,186,076,237,245,01
     0
```

File Protection

Will Kaczmarek

If you want to protect your program files from unauthorized use, CHR$(0) can help. To protect a file, save your program like this:

SAVE CHR$(0)+*"filename"*,8

When the file is listed in the directory, only the last few letters of the filename are displayed, and the file size appears ridiculously large, usually exceeding 10,000 disk blocks (the file is not actually this large, of course).

The only way to access the program is to load it using the same format in which it was saved:

LOAD CHR$(0)+*"filename"*,8

To the average computerist—and even to many experienced ones—this file appears impossible to load. This tip works on all 1541-compatible drives.

Easy File Scratch

James Liek

This short program provides a fast and easy method to delete several files from disk. Type it in, save a copy, then load and run it. You'll be asked if you want to scratch a file. Just press Y for yes and type in the filename of the file you wish to delete. Before pressing RETURN, be sure that you have inserted the disk that contains the file or files you wish to scratch. After the scratch is complete, the prompt will again be displayed. You can continue to scratch files for as long as you like. Press N to quit. The program works on the Commodore 64, 128, Plus/4, and 16.

```
10 PRINT "{CLR}"
20 PRINT:PRINT "WOULD YOU LIKE
     TO SCRATCH A FILE (Y/N)?
     "
30 GET A$
40 IF A$="Y" THEN 80
50 IF A$<>"N" THEN 30
60 PRINT:PRINT "BYE."
70 END
80 INPUT "FILE TO BE SCRATCHED
     ";F$
90 OPEN 15,8,15
100 PRINT#15,"S0:";F$
110 INPUT#15,E,E$,F
120 CLOSE 15
130 PRINT:PRINT F;E$
140 GOTO 20
```

Autorun Programs

Eric Ferro

Here's a very useful technique that makes your 64 programs run automatically when loaded. To use it, you must add this line to your BASIC program:

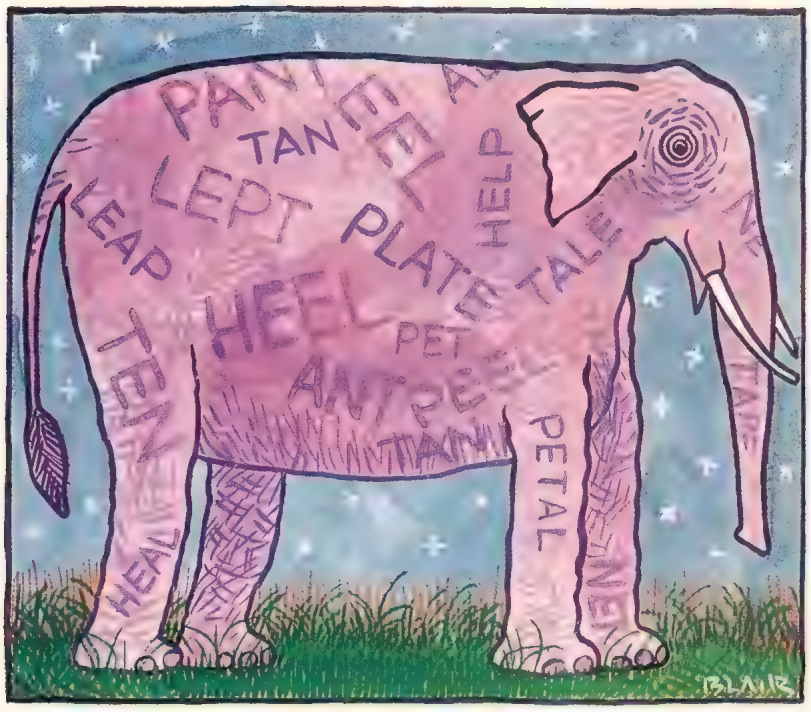
0 POKE 770,131:POKE 771,164

Now, save the program like this:

**PRINT"{CLR}":POKE770,113:
POKE771,168:POKE43,0:POKE44,3:
POKE157,0:SAVE*"filename"*,8**

where *filename* is the name of the program to be autorun. After the program has been saved, the computer locks up, continually flashing READY at the top of the screen. To return things to normal, simply turn your computer off and on.

Now the command LOAD *"filename"*,8,1 automatically loads and runs your program. If you do not include the ,1 extension, the program does not work properly.



Scrambler

Rhett Anderson and David Hensley, Jr.

Grab a dictionary—you'll need it to settle the disputes that arise when you play Scrambler, *a challenging word game for one to four players. For the Commodore 64. Disk drive required to save high scores but not to play game.*

How many words can you make from the letters in the word *Thanksgiving*? Tank, shin, knit, gnat, gin, thin . . .that's a few. If you can find more, you'll enjoy "Scrambler," a word game that will keep you on the edge of your seat. Play head-to-head against up to three opponents or play for a high score on your own.

Scrambler has many features that will sharpen your skills—a countdown timer, an intelligent keyboard routine that doesn't let you use unavailable letters, and a duplication checker that makes sure you don't type the same word twice. If you have a disk drive, your high scores will be saved to disk.

Getting Started

Scrambler is written entirely in BASIC. Using the "Automatic Proofreader" program found elsewhere in this issue, carefully type in Scrambler and save it to tape or disk before attempting to run it.

When you're ready to play a game of Scrambler, load the program and type RUN. If you're using a disk drive, Scrambler looks for a high score file called SCRAMBLER .HIGHS. If it can't find a file with this name, it will create one.

Scrambler first asks you how many people will be playing. Enter a number from 1 to 4. Next, when Scrambler asks for the names of the players, type them in one at a time. Scrambler asks whether you want to play "words" or "points." Choose words if you want Scrambler to score each word as one point. Choose points if you'd rather have the game reward more points to long words than to short ones. Finally, choose how long you want the game to last. Scrambler is a timed game. You may choose to play a 1-, 3-, 5-, or 7-minute game.

In the Hot Seat

Before you start the game, decide on the rules. Will you allow proper nouns? Are slang words acceptable? What about single-letter words like *I* and *A*? You might want to use a dictionary to resolve disputes.

The first player should be seated at the computer's keyboard. Press a key to begin the game. Thirteen letters appear at the top of the screen. The player uses these letters to create words. The letters are different every time a round is played. This keeps players from memorizing a list of words.

The letters can each be used once. You can't use the word *mess* if you have only one *s*, but you can use it if you have two.

Scrambler won't let you type the same word twice. If you try it, you'll hear a buzz and the word will disappear.

Keep an eye on the timer—it shows the number of seconds remaining on the clock. The border of the screen turns red when you have 20 seconds left. When time runs out, you'll be asked if you would like to delete any of the words you typed. If you answer *Y*, you can step through each word you typed and check it in the dictionary. Press Y to keep the word, N to delete it. After the score has been reported, the next player gets a chance to play with a new set of letters.

"Scrambler" is a simple-to-play but demanding word game.

High Scoring

At the end of the game, the winner will be announced. If the high score beats the previous high score stored on disk, the SCRAMBLER.HIGHS file will be updated. Note that a high score is kept for each type of game—there are eight combinations of scoring and time options

See program listing on page 74.

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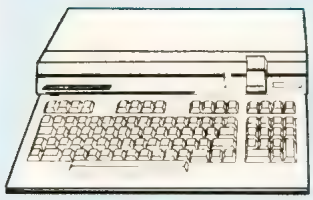

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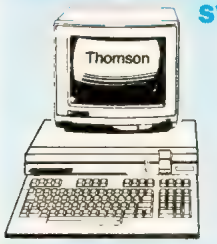

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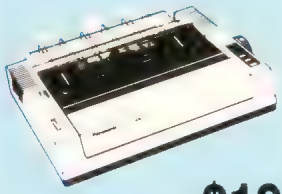

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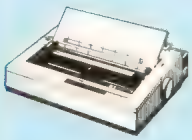

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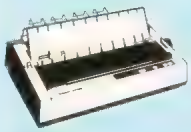

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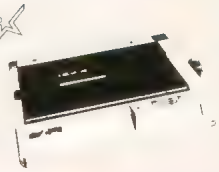

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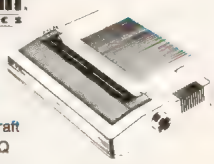

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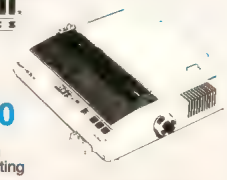

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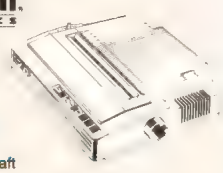

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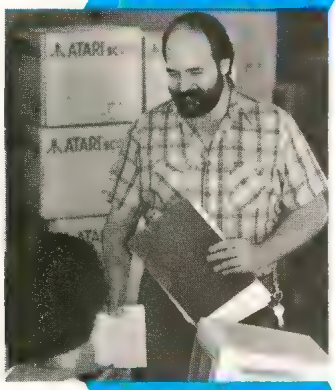

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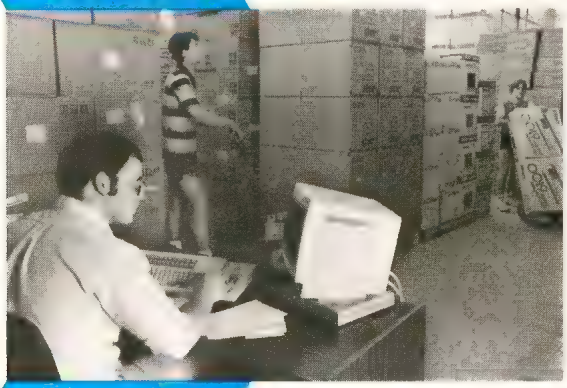

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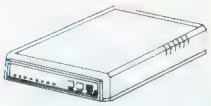

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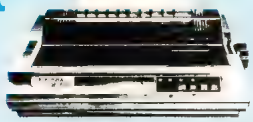

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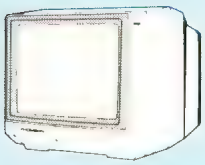

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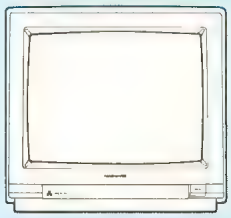

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V-8

Turbocharged Graphics for the 64

Stephan R. Borden

Add enormous graphics power to your 64 with this powerful but easy-to-use program. It adds the software equivalent of seven additional VIC-II chips to your computer.

The VIC-II is the engine that drives the Commodore 64's powerful graphics. It controls eight sprites, produces high-resolution graphics with 16 colors, does smooth-scrolling, allows programmable character sets, and more. But imagine the effects you could achieve if the 64 had, say, two or three VIC-II chips to spare. Mixed text and graphics, additional sprites, or multicolored borders and backgrounds would be just a few POKEs away. The graphics you could create would be incredible.

"V-8" gives your 64 the power of up to *eight* VIC-II chips. With it, you can divide the screen into multiple sections, each of which functions independently of the others and retains almost all of the video chip's usual features. Using V-8, you can put 64 sprites, eight background colors, and high-res graphics with text, all on the screen simultaneously. And, as you'll soon see, that's really only a small sample of what's possible with V-8.

Typing It In

Program 1, "V-8 Loader," is a BASIC program used to create V-8, which is a machine language program. Enter it using "The Automatic Proofreader," found elsewhere in this issue. Programs 2–6 are BASIC demonstration programs. Carefully type them in and save a copy of each program.

Once Program 1 has been saved, you're ready to load and run it. Type RUN. There's a short delay as the data is POKEd into memory. Once this is done, the starting and ending addresses and length of V-8 are displayed on the screen. At this point, V-8 Loader can save a copy of V-8 on disk if you wish. This option can be used to change V-8 Loader to create a customized V-8 file to suit your needs (see "Customizing V-8" below), but for now ignore the save option and answer N to the SAVE IT TO DISK? prompt.

Next, V-8 Loader displays a list of six important POKE and SYS commands as shown in Table 1. Although V-8 is a machine language program, you don't need to know machine language to use it. A familiarity with the traditional POKEs used to create graphics is all you need to get started. If you're unfamiliar with programming graphics, there are many books on Commodore 64 graphics. A copy of COMPUTE! Books' *Mapping the 64* is also helpful.

Hundreds of Registers

Creating graphics with V-8 is not much different from creating graphics without it. The VIC-II chip has 56 registers for such things as vertical and horizontal fine scrolling, enabling and controlling the horizontal and vertical positions of sprites, and so on. You write to these registers with BASIC's POKE command. With V-8's eight simulated VIC-II chips, you still use the POKE command, but instead of 56 registers, you now have eight times as many—448 registers in all.

With one exception, noted below, you must POKE to this section of "shadow" registers; POKEing to the normal video registers won't work. This section of 448 registers (located at 49152 by default) is subdivided into 56 blocks of eight bytes each. Each block is responsible for a different video function and each byte within the block controls that function for a corresponding shadow VIC-II. Blocks 0–46 control the VIC-II registers 53248–53294 ($D000–$D02E). Block 47 controls the video bank address at location 56576 ($DD00). Blocks 48–55 are the sprite pointer registers which normally reside at 2040–2047 but move if the screen location or video bank address is changed. Table 2 shows a detailed layout of the shadow registers.

Calculating the correct locations to POKE is not as difficult as it may seem. Most BASIC programs set a variable (usually V) equal to 53248—the start of the VIC chip—

Table 1: POKE and SYS Commands

Command	Function
POKE 49665,X	Number of splits in screen
SYS 49825	Initializes Shadow Registers
SYS 49664	Activates V-8
SYS 49746	Deactivates V-8
49152–49599	Shadow Registers
49873–49928	Table of Defaults

Table 2: Layout of V-8 Shadow Registers

Shadow VIC-II								Register Function
0	1	2	3	4	5	6	7	
0	1	2	3	4	5	6	7	Sprite 0 X Coordinate
8	9	10	11	12	13	14	15	Sprite 0 Y Coordinate
16	17	18	19	20	21	22	23	Sprite 1 X Coordinate
24	25	26	27	28	29	30	31	Sprite 1 Y Coordinate
32	33	34	35	36	37	38	39	Sprite 2 X Coordinate
40	41	42	43	44	45	46	47	Sprite 2 Y Coordinate
48	49	50	51	52	53	54	55	Sprite 3 X Coordinate
56	57	58	59	60	61	62	63	Sprite 3 Y Coordinate
64	65	66	67	68	69	70	71	Sprite 4 X Coordinate
72	73	74	75	76	77	78	79	Sprite 4 Y Coordinate
80	81	82	83	84	85	86	87	Sprite 5 X Coordinate
88	89	90	91	92	93	94	95	Sprite 5 Y Coordinate
96	97	98	99	100	101	102	103	Sprite 6 X Coordinate
104	105	106	107	108	109	110	111	Sprite 6 Y Coordinate
112	113	114	115	116	117	118	119	Sprite 7 X Coordinate
120	121	122	123	124	125	126	127	Sprite 7 Y Coordinate
128	129	130	131	132	133	134	135	Sprites 0–7 X MSB
136	137	138	139	140	141	142	143	Control Register 1
144	145	146	147	148	149	150	151	Raster Register
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Light Pen X Coordinate
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Light Pen Y Coordinate
168	169	170	171	172	173	174	175	Sprite Enable
176	177	178	179	180	181	182	183	Control Register 2
184	185	186	187	188	189	190	191	Sprites 0–7 Y Expansion
192	193	194	195	196	197	198	199	Memory Control
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Interrupt Flags
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Interrupt Enable
216	217	218	219	220	221	222	223	Sprite Background Priority
224	225	226	227	228	229	230	231	Sprites 0–7 MCM
232	233	234	235	236	237	238	239	Sprites 0–7 X Expansion
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Sprite/Sprite Collision
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Sprite/Data Collision
256	257	258	259	260	261	262	263	Border Color
264	265	266	267	268	269	270	271	Background Color 0
272	273	274	275	276	277	278	279	Background Color 1
280	281	282	283	284	285	286	287	Background Color 2
288	289	290	291	292	293	294	295	Background Color 3
296	297	298	299	300	301	302	303	Sprite MCM 0
304	305	306	307	308	309	310	311	Sprite MCM 1
312	313	314	315	316	317	318	319	Sprite 0 Color
320	321	322	323	324	325	326	327	Sprite 1 Color
328	329	330	331	332	333	334	335	Sprite 2 Color
336	337	338	339	340	341	342	343	Sprite 3 Color
344	345	346	347	348	349	350	351	Sprite 4 Color
352	353	354	355	356	357	358	359	Sprite 5 Color
360	361	362	363	364	365	366	367	Sprite 6 Color
368	369	370	371	372	373	374	375	Sprite 7 Color
376	377	378	379	380	381	382	383	16K Video Bank
384	385	386	387	388	389	390	391	Sprite 0 Definition
392	393	394	395	396	397	398	399	Sprite 1 Definition
400	401	402	403	404	405	406	407	Sprite 2 Definition
408	409	410	411	412	413	414	415	Sprite 3 Definition
416	417	418	419	420	421	422	423	Sprite 4 Definition
424	425	426	427	428	429	430	431	Sprite 5 Definition
432	433	434	435	436	437	438	439	Sprite 6 Definition
440	441	442	443	444	445	446	447	Sprite 7 Definition

Note: These numbers are an offset into shadow register memory. For example, to calculate the address of the first shadow VIC-II's sprite 0 definition, add 384 to the beginning address of shadow register memory.

and reference its registers as the sum of V and a number from 0 to 46.

The reasoning behind this is that it's easier to work with the numbers 0–46 than it is to work with the numbers 53248–53294. For example, most programmers use POKE V+21,255 (as opposed to POKE 53269,255) to turn on all sprites. If you're accustomed to using this method, you should have no trouble using V-8; you just have to modify the formula slightly. With V-8, the previous example becomes POKE V+21*8+N,255 where V is the start of the shadow registers, 21*8 is the base offset for the sprite enable registers, and N is the number (0–7) of the VIC-II chip or screen section you want to control.

As a second example, say you had the screen divided into four sections and you wanted to change the border color on the third section to yellow. The border color register is at 53280 or V+32. The number of the screen you want to change would be 2 (not 3—remember to start counting at 0), and 7 is the color code for yellow. Now just

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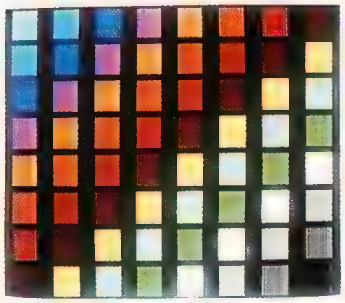

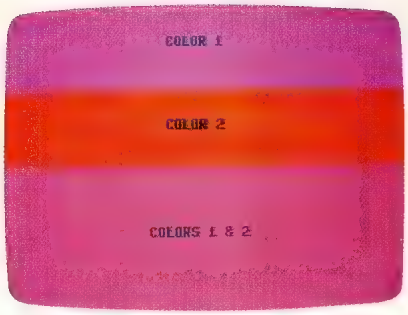

make sure V has already been set to the start of your shadow registers and POKE V+32*8+2,7. That's all there is to it.

The Demos

If you'd like to learn how to create some more elaborate effects with V-8, take a look at the five demonstration programs. They're written entirely in BASIC (except for Program 3, which uses a machine language routine to quickly clear the hi-res screen, and Program 4, which requires a short machine language routine to move the scrolling text one space to the left).

Program 2, "Fade In/Out," creates the opening and closing screen effect by splitting the screen into two different background colors and continuously changing the raster registers.

Program 3, "Mixed Modes," shows how high-resolution graphics and normal text can be displayed on the same screen.

Program 4, "Window Scroll," creates a one-line section at the bottom of the screen which can scroll smoothly and independently of the rest of the screen.

Program 5, "Color Creator," allows you to add to the 64's palette of 16 colors—something you probably didn't realize was possible. It does this by taking two regular colors and switching between them very rapidly. Many combinations flicker too much to be usable, but you may be surprised at the stability of others. The flickering can even be used to advantage in some cases—to liven up a game, for example. The best color combinations are ones that are of approximately equal brightness levels, such as red and purple. Use the left and right cursor keys to cycle through all the possible combinations.

Program 6, "64 Sprites," puts 64 sprites on the screen. Although the sprites appear as solid blocks, it's possible to give them all different definitions. The sprites can be moved horizontally across the entire screen, but vertical movement is limited to a narrow strip.

Program 6 demonstrates an easy method of experimenting with V-8. The contents of all the registers are listed in data statements starting at line 1000. For instance, list line 1021. As you can see by the REM statement, this line controls the sprite enable registers. If you change the numbers in the line to 255, 0, 255, 0, 255, 0, 255, 0 and run the program again, you see sprites in only four of the eight sections (doing this changes the checksum in line 50, so put a REM in front of line 50 if you decide to try this). As you can see, it's easier to change a few data items than it is to type in eight POKE commands.

Creating a Screen

Once you understand the basic principles, you can put V-8 to work. Run the V-8 Loader again and let it create V-8 on disk. Turn your computer off and then back on, and load the copy of V-8 that you just created by typing LOAD "V-8",8,1. After it has loaded type NEW.

To demonstrate how easy it is to use V-8, let's create a simple display by dividing the screen into three equal sections. Each section will have a different border and background color. Before creating anything with V-8, there are several things we must do. First, we must tell the program how many screen sections we want. This is accomplished with the first POKE command in Table 1. Since we want three split screens, type POKE 49665,3.

The second step is to initialize the shadow registers. If we turn on V-8 without doing this, the random values in the registers create a lot of garbage on the screen and could possibly crash the computer. Type the second command in Table 1, SYS 49825, to initialize the registers. The default values stored in the shadow registers during initialization are contained in a 56-byte table stored at the location shown in Table 1. Each byte in this table will go into corresponding positions in each of the eight shadow registers, so each shadow VIC-II chip will have identical values in registers that perform like functions. This means each chip will be initialized with the same background color, border color, and so on.

V-8 can now be enabled safely by typing the third command in Table 1, SYS 49664. If you followed directions correctly, nothing will appear to have happened; however, each shadow VIC-II chip is now getting its information from the shadow registers, and the screen has now been divided into three sections. Of course, since each section is identical, you can't see any difference.

The next step is to tell V-8 where each screen section should begin and end. To do this, you must POKE the ending raster line of each screen area to its shadow register. The visible screen (excluding the border) starts at raster line 50 and ends at raster line 249. With 200 lines to work with, three equal sections will be about 67 lines each. The first section ends at line 50 + 67, or line 117. The second section ends at line 117 + 67, or line 184. The third section can end at line 1 so as to include the lower border. Using what we have already learned, we can POKE these values in. First set variable V equal to the start of shadow registers by typing V=49152. Table 2 shows that the raster control registers begin at a base offset of 18*8, so the following line can be used to specify each section:

```
POKE V+18*8,117: POKE V+18*8+
1,184: POKE V+18*8+2,1
```

The screen is now divided into three equal sections. To make these divisions visible, let's change the border color of each section. We'll make the top section red, the middle section white, and the bottom section blue. Table 2 shows that the border color has a base offset of 32*8, so we can use the following line:

```
POKE V+32*8,2: POKE V+32*8+1,1:
  POKE V+32*8+2,6
```

You should now see the border divided into three different colors. Let's go one step further and make a flag design by changing the screen background too. The POKEs to do this are almost identical to the previous ones—the color values are the same except now we're changing the background color instead of the border color. Just reenter the previous line changing the 32s to 33s, like this:

```
POKE V+33*8,2: POKE V+33*8+1,1:
  POKE V+33*8+2,6
```

You should now have red, white, and blue sections on the screen. To turn off the display and reset the VIC-II chip to the values in the default table use the last command from Table 1, SYS 49746. To reenable the display, type SYS 49664.

Customizing V-8

V-8 can be customized to make it more convenient and more efficient. In line 10 of Program 1, the variable S controls the starting address of the program, and the variable V controls the starting address of the shadow registers. You can relocate V-8 and the shadow registers anywhere you want them. V-8 requires a 639-byte area, while the shadow registers require 448 bytes.

Note that the SYS to turn on V-8 is always its starting address. The SYS to turn it off is always the starting address plus 82. The initialization SYS is the starting address plus 161. The number of times you wish to split the screen is always POKEd into the starting address plus 1. The table of defaults begins at the starting address plus 209. If you put the following line at the beginning of each program that uses V-8, it will be much easier to remember these SYSs and POKEs:

```
10 V=49152:S=49664:O=S+82: I=S+
  161:NM=S+ 1:DF=S+209
```

Using this code, the number of times the screen will be split is specified with POKE NM,*X*, where X is the number of screen splits. The shadow registers can be initialized with a simple SYS I. V-8 is activated with SYS S, and SYS O deactivates V-8. This will make V-8 easily relocatable: To make your program work with a relocated version of V-8, just change the variables V and S to the new shadow register address and V-8 starting address, respectively.

You may notice in your experiments with V-8 an occasional flicker or "creeping" of the display. There are two reasons for this. First of all, the 64 has to do other things besides keep track of the raster. It has to scan the keyboard, update the clock, and of course, run your program. Occasionally, the raster interrupt will be ready to occur, but the computer already will be in the middle of some other task. It can't immediately stop what it's doing, so in the meantime, the raster will move down a few lines. When the computer does change the display, it will be too late. In almost all cases, you can avoid this problem by keeping the split screens as wide as possible and by ending the last split screen on a line that is not visible on your monitor (line 1 should work fine).

A second kind of disturbance occurs because V-8 has so much work to do in a very short amount of time. Specifically, 56 registers have to be updated in the time it takes one raster line to be drawn—about 1/15,780 second. Even machine language isn't fast enough to do this. Thus, you may notice that certain parameters won't change on the exact line that you specify, but a few lines lower. The registers that V-8 takes care of first, like the sprite coordinates registers, may be changed while the raster is on one line, but by the time V-8 gets to, say, the background colors or the sprite definitions, the raster may have moved several lines.

Fortunately, V-8 can be modified to avoid this problem. Very few programs you write will need to change all 56 registers at every raster interrupt. You can create customized versions of V-8 which will change only the registers you require. To do this, you must modify lines 1190–1270 of V-8 Loader. List these lines and you'll see a series of 1s, 0s, and −1s followed by a REM statement. The numbers correspond to the registers described in the REM statement. At the moment, most of these numbers will be 1s. Simply change the registers you don't need to 0s, and the program won't include them in the finished routine.

The seven −1s signify registers that are not and never should be included in V-8. They include the light pen registers (who would need eight light pens?), the interrupt registers (using them would confuse V-8), and the sprite collision registers (which don't really work right when there are more than eight sprites on the screen). If your program must check for sprite collisions, it can be done by checking the sprite coordinate registers, and if they're equal or approximately equal, a collision is occurring. You may also have noticed that the raster register is set to −1. As you know, the program requires this register, so it's automatically included; setting it to 1 would be redundant. Also remember that all the registers that you don't include in V-8 require POKEs to their usual locations, not the shadow registers.

A second way to speed up V-8 is by omitting the sprite pointer registers or setting them at a constant address. Unlike the other video registers, the sprite pointers may not always be in the same place. They are always the last eight bytes of a 1K chunk of screen memory, but if you move screen memory or the 16K bank that the VIC chip is using, the sprite pointer locations will also move. V-8 can deal with this, but it takes extra time to perform the necessary calculations. If you don't need more than eight sprite definitions onscreen at once, the best thing to do is simply set all the pointer flags in line 1270 to 0s. If you do need more than eight definitions but don't plan to move the screen or video bank, set PG in line 10 of V-8 Loader to the page where the sprite pointers will be. The page number can be determined by dividing any of the pointer locations by 256 and discarding the remainder. Both of these modifications will avoid some time-consuming code and should improve the display significantly. Remember though that if

you do plan to move screen memory, PG must be set to 0.

The final modification you can make to V-8 is changing the default table in lines 1060–1140 of V-8 Loader. These are the values that are stored in the shadow registers when they are initialized and stored in the real video registers when the program is turned off.

When experimenting with V-8, use a fully configured version. After you're sure what you want to do, you should create a customized version. When you create a new version, be sure to write down what registers, SYSs, and POKEs it uses so you can find the version you need when you need it, and have the right commands on hand. Your programs will also look more professional if you set up the shadow registers before you SYS to turn on V-8. Otherwise, you'll see a lot of flickering, and so on, as your screen is being created.

How It Works

You don't have to know how V-8 works to use it, but you may be curious. Its secret lies in a hardware feature of the 64 known as the *raster interrupt.* The raster is the beam of electrons that scans your TV or monitor left to right, top to bottom, drawing the screen as it goes. It moves very rapidly—within one second the screen is redrawn 60 times.

Memory location 53266 ($D012) and bit 7 of location 53265 ($D011) form a number from 0 to 262 which represents the current raster scan line. Because the contents of these registers change so quickly, they must be read from machine language. By storing a raster line value in these registers, it's possible to make the computer interrupt what it's doing when it reaches that line and transfer control to an ML routine (this is known as a raster interrupt). The ML routine can cause some change in the visible display, creating what is known as a *split screen.*

For example, say you wanted to give the top half of the screen a black background and the bottom half a white background. You would set up a raster interrupt to occur at line 150 (the middle of the screen) and at line 1 (the top of the screen). Whenever the raster reached line 150, your routine would set location 53281 (the background color) to a 1 (white). When the raster returns to line 1, location 53281 would be set back to 0 (black). Because these changes occur within one frame of the video display, there appears to be a distinct split in the middle of the screen where the background turns from black to white.

V-8 creates up to eight raster interrupts for you. All you have to do is specify new video parameters for each interrupt through a series of POKEs very similar to the POKEs you use to create graphics. The background color is not the only thing that can change during these interrupts. Any or all of the VIC-II registers, the 16K video bank address at location 56576 ($DD00), and the sprite pointers may also change. The net effect of this is like having several VIC-II chips, each controlling a different section of the screen and each with its own set of registers.

Ideas to Try

The demos in this article only touch upon some of the things possible with V-8. Here are some suggestions of things to try once you become more proficient with it:

- Bitmap the screen—or a section of it—with custom characters or sprites.
- Access all 64K of memory with the VIC-II chip. Normally you can access only 16K at once, and programming gets complicated if all your graphics data won't fit there. With V-8, you can put data wherever you want and just change the video bank address (V+47*8+N) to the appropriate bank to access it.
- Divide the screen into sections, with each section scrolling smoothly in a different direction or at a different speed. You will have to know some machine language to accomplish this.
- Erase the upper and lower borders and put sprites there. (This effect is described in "Impossible Scroll" in the September 1987 *GAZETTE.*)
- Make multicolored sprites with 16 colors.

Some of these ideas may not seem particularly useful, but they do produce some interesting effects. In any case, there is still a tremendous number of possibilities you can explore with V-8.

See program listings on page 75.

Error Analyzer

Sanjoy Dasgupta

This short utility makes debugging BASIC programs easy by providing more information about errors. If ?SYNTAX ERROR just doesn't help you understand the problem, then this utility is for you. For the 64.

Understanding and interpreting error messages is an essential part of debugging a BASIC program. Many of BASIC's error messages make it very clear what caused the error. For example, an ?UNDEF'D STATEMENT ERROR can only occur if your program references a nonexistent line number. However, other error messages, such as ?SYNTAX ERROR, are not so clear. Some have so many possible causes that they leave you wondering what actually went wrong. In BASIC 7.0, Commodore eliminated some of this vagueness by providing the HELP command. The HELP command lists the line causing the problem and highlights the location of the error within the line. "Error Analyzer" adds this capability and more to BASIC 2.0.

Whenever an error occurs, Error Analyzer provides a more detailed explanation of the error, if it can, and then displays the normal BASIC error message. (The normal error message will be printed regardless of whether Error Analyzer can provide further details or not.) If the error occurs in program mode, the offending line will also be listed, with an inverse asterisk indicating the exact position of the error within the line.

Typing It In

Error Analyzer consists of two programs. "ERROR.BOOT," Program 1, is a BASIC loader that loads and installs the machine language portion of Error Analyzer. Program 1 should be entered using "The Automatic Proofreader" located elsewhere in this issue. "ERROR.OBJ," Program 2, contains the machine language routines that are the heart of Error Analyzer. You'll need "MLX," the machine language entry program also found in this issue, to enter Program 2. MLX will ask for the starting and ending addresses of the data you're entering. Use the following values for ERROR.OBJ:

Starting address: C000
Ending address: C2E7

Be sure to save Program 2 on the same disk as Program 1 with the name ERROR.OBJ. Next, load and run Program 1, the loader. There will be a short delay while Error Analyzer installs itself in a safe area at the top of BASIC memory. Pressing RUN/STOP–RESTORE will disable Error Analyzer. Reenable it with POKE 1,54.

Error Analyzer can provide extra information on several types of errors. Here are the error messages that Error Analyzer may print:

- — EXPECTED
- MISSING)
- EXTRA CHARACTERS
- MUST BE POSITIVE
- MUST BE LESS THAN 256
- MUST BE −32768 TO 32767
- NUMERIC TYPE EXPECTED
- STRING EXPECTED
- % VARIABLES DISALLOWED
- OPERATOR USED TWICE
- OUT OF STACK SPACE

— **EXPECTED.** The computer expected to find a particular character but didn't, thus causing a syntax error. For example, enter this line: **10 INPUT "NAME:"N$**. Now run the short program. The program will stop, and Error Analyzer will display

```
; EXPECTED
?SYNTAX     ERROR IN 10
10 INPUT "NAME:"*N$
```

The first line is Error Analyzer's explanation of what went wrong (the computer expected a ;). The second line is the normal Commodore error message. Finally, the third line is the program line itself with an inverse asterisk indicating the point where the error occurred (where BASIC expected to find a ;). To correct the line, simply move the cursor over the asterisk, type a semicolon, and press RETURN.

MISSING). BASIC couldn't find the closing parenthesis for an expression. For example, entering PRINT TAB(8 in immediate mode would yield

```
MISSING )
?SYNTAX     ERROR
```

EXTRA CHARACTERS. BASIC found characters that weren't necessary for the current command. In some BASICs, this line would be legal: **10 POKE 49152,1,2,3,4**. Without the aid of Error Analyzer, this error could be difficult for someone unfamiliar with Commodore BASIC to trace.

MUST BE POSITIVE. Some BASIC funtions require positive values as arguments. If one of these functions is passed a negative value, the result would be

```
MUST BE POSITIVE
?ILLEGAL QUANTITY     ERROR
```

MUST BE LESS THAN 256. BASIC commands and functions that work on byte values require their numeric arguments to be less than 256 (255 is the largest value that can be stored in one byte). Passing such a command or function a value greater than 255 will cause Error Analyzer to display MUST BE LESS THAN 256.

MUST BE −32768 TO 32767. Integer variables (and parameters for many of the BASIC commands and functions) must have values in the range −32768 to 32767. Values outside this range will result in a MUST BE −32768 TO 32767 error.

NUMERIC TYPE EXPECTED. Error Analyzer displays this message if BASIC finds a string expression where it expected a numeric expression. For example, typing PRINT CHR$("H") would display

```
NUMERIC TYPE EXPECTED
?TYPE MISMATCH     ERROR
```

STRING EXPECTED. This error message is the inverse of the previous one. Error Analyzer prints it when BASIC finds a numeric expression where it expected a string. For example, typing PRINT ASC(8) gives

```
STRING EXPECTED
?TYPE MISMATCH     ERROR
```

% VARIABLES DISALLOWED. Error Analyzer prints this message when BASIC finds an integer (%) variable where one isn't allowed. The index in a FOR..NEXT loop is an example of a variable that cannot be an integer.

OPERATOR USED TWICE. Operators are mathematical symbols like = and +. You cannot use them more than once (as in IF X<<3 THEN END) in an expression. Error Analyzer will display this error message if you use an operator more than once in the same expression.

OUT OF STACK SPACE. GOSUBs and FOR..NEXT loops use the stack extensively. If a program jumps out of a subroutine (a section of code called by a GOSUB) or a FOR..NEXT loop, garbage is left on the stack. If this happens several times, the stack will fill up, and BASIC will return an ?OUT OF MEMORY ERROR. In such a situation, printing FRE(0) will usually show that BASIC still has plenty of memory with which to work. The problem is not that BASIC is actually out of memory, but that it has overflowed the stack. Error Analyzer's OUT OF STACK SPACE message should clear up any confusion.

This list represents only a fraction of the errors that you can generate using BASIC. Even if Error Analyzer doesn't print its own description of an error, it will still show the normal BASIC error message. In addition, if the error was encountered in program mode, it will also list the erroneous line with an inverse asterisk marking the place the error occurred. Sometimes just knowing where in the line the error occurred can be a great help.

Interpreting Error Messages

Sometimes, the explanations printed by Error Analyzer may not seem to make much sense. For example, type in **POKE 3000,@** and Error Analyzer displays

```
( EXPECTED
?SYNTAX     ERROR
```

The Error Analyzer's explanation may seem odd at first glance. After POKE 3000, BASIC reads the @. First it checks to see if it's a number, and then it checks to see if it's a numeric variable. Since the @ is neither of these, there is only one other thing it could be: a numeric expression within parenthesis. Since the @ is not an opening parenthesis, Error Analyzer prints the error message (EXPECTED. Remember, if you don't understand Error Analyzer's error message, you'll always have the normal BASIC error message to fall back on.

Compatibility

Error Analyzer is designed to be compatible with most other programs. Although the values you gave MLX suggest that Error Analyzer occupies the area C000–C2E7 in memory, this is not the case. ERROR.BOOT loads Error Analyzer at the top of the BASIC text space and protects it from other programs. If other utilities also install themselves in this area, Error Analyzer will place itself immediately below these utilities. Error Analyzer takes up 742 bytes of BASIC text space so the amount of free memory will be reduced slightly.

Error Analyzer is very flexible. It will probably adapt itself to other BASIC utilities in memory. For example, if you're using a package that adds new BASIC commands (such as "MetaBASIC"), Error Analyzer will often print error descriptions when you misuse the new commands. If you plan to use Error Analyzer with other utilities, remember to load Error Analyzer after the other utilities.

How It's Done

Error Analyzer first copies BASIC ROM to the underlying RAM and then switches out BASIC ROM. A problem can occur here that is overlooked by most ROM-changing utilities. If you've already installed a utility that changes both BASIC and Kernal ROM, that utility would have cleared bit 2 of memory location 1. If Error Analyzer were to clear bit 1 as well, the computer

would crash. Therefore, Error Analyzer checks to see whether BASIC and the Kernal have already been switched out. If they have, it doesn't clear bit 1 of location 1.

After copying the ROM, Error Analyzer makes extensive changes to BASIC. BASIC has several special routines that check for errors. For example, the routine at $AEF7 checks for a (character. In addition to these error-checking routines, some commands check for errors themselves. Error Analyzer intercepts a large number of these routines and prints an error explanation if BASIC finds an error.

Listing the erroneous line with an inverse asterisk indicating the position of the error is a three-step process.

- When a program-mode error occurs, BASIC eventually reaches location $A471, which is part of the routine that displays IN LINE XXX. Error Analyzer changes the JMP $BDC2 at this location to JMP to a routine of its own.
- The new routine (which starts with JSR $BDC2) reads the character pointed to by the text pointer ($7A) and stores it. The offending character is then replaced by a $01. A $01 should not normally be present in a BASIC program line as it is neither a token nor a printable ASCII code.
- Next, the list vector is changed, and the list routine is called to list the line. Each time a character in the line is to be printed, the computer jumps to the new list routine. This routine checks whether the character is $01. If it isn't, it jumps to the normal list routine. If it's $01, Error Analyzer prints an inverse asterisk. It then prints the character which was previously saved and replaced by $01. This character is also put back into the program line. Once this is done, the list vector is restored to its previous value.

Error Analyzer was written with the aid of *Toolkit: BASIC* (COMPUTE! Books), a BASIC ROM reference manual by Dan Heeb. Despite a few minor errors, this book and its companion volume *Toolkit: Kernal* are excellent. They describe the 64's BASIC and Kernal ROM in great detail and are a boon for advanced machine language programmers.

See program listings on page 69.

SYS Stamper

Phil Kinkade

Ever forget the SYS address for a machine language program? This program will save you hours of time. With "SYS Stamper" you can display the SYS address of each program right in the disk's directory, so it's always handy. For the 64, 128, Plus/4, and 16.

Remembering the starting address for every machine language program you use is probably impossible. If you've ever spent time searching through back issues of your favorite computer magazine to find the execution address for a program, then "SYS Stamper" is just what you need. Since this time-saving utility is written entirely in BASIC, it's as easy to type in as it is to use.

Getting Started

After you've typed in SYS Stamper, save one copy of the program on a scratch disk and one copy on a different disk. To be safe, the programs on the scratch disk should be backed up before you run SYS Stamper. A typing error in this program could destroy important directory information.

Now you're ready to run the program. Put the scratch disk in the drive and type RUN. Remember, an incorrect copy of this program can corrupt other programs on the disk, so make sure it's working properly before using it on important disks.

SYS Stamper presents you with three options: select a file for stamping, go to the next sector, or exit the program.

You select the file by pressing the number appearing to the left of the filename. If you don't see the file you want, press the number displayed to the left of NEXT SECTOR. This displays the filenames from the next sector of the disk directory.

When all filenames have been displayed, LAST SECTOR is printed at the top of the screen. For example, on a disk containing 14 files, running the program shows the first eight filenames. Pressing 9 displays the next six filenames and the LAST SECTOR message. Now press 7 to return to the first eight filenames.

Sectors with less than eight filenames occur when files have been deleted or the sector has not yet been filled.

After selecting a file, type in the SYS address for the program selected. This can be any integer between 0 and 65535. (It doesn't have to be the starting address of the file.) This number is instantly written to your disk and shown on the screen. Now you return to file selection, where you can choose another file or exit the program by pressing 0.

Find the Address

You don't need a copy of SYS Stamper to view the addresses in your directory. The SYS number replaces the file length number. To read the SYS addresses, just display a directory in normal fashion—you'll see that the addresses are listed before the filenames. This program modifies the directory track by replacing the file length with the numbers you enter. The files themselves aren't altered. You can erase the address stamps by resaving the programs with the same names.

See program listing on page 72.

Emergency BASIC

James Host

View directories, perform calculations, and even run short BASIC programs at any time with this unique utility for the Commodore 64.

Have you ever wished that you had a second Commodore 64 next to the one on your desk? You could use it to get directories of your disks, convert hexadecimal numbers to decimal, or even run another program. "Emergency BASIC" gives you a second 64. At any time, in nearly any program, a special keypress pops you into BASIC. When you've finished, another keypress returns you to your program, which continues as if it had never been interrupted.

Typing It In

Emergency BASIC is written entirely in machine language. To enter it, you must use "MLX," the machine language entry program found elsewhere in this issue. When you run MLX, you are asked for the starting and ending addresses of the data you'll be entering. Here are the values to use with Emergency BASIC:

Starting address: 0801
Ending address: 0AC8

Follow the MLX instructions carefully, and be sure to save a copy of the Emergency BASIC data before exiting MLX. Although it is written in machine language, Emergency BASIC can be used just as you'd use a BASIC program.

To use the program, just load it and type RUN. Emergency BASIC remains in memory, dormant, until it is needed. To invoke Emergency BASIC, hold down the CONTROL key and tap RESTORE. Release the CONTROL key to enter the new BASIC environment.

You are now free to do anything you normally do in BASIC—and you won't corrupt the program you are running.

When you're ready to return to your main program, repeat the keypress you used to enter Emergency BASIC: Hold down the CONTROL key, tap RESTORE, then release the CONTROL key.

Emergency BASIC works with most BASIC and many machine language programs, but it does *not* work with programs which interfere with the areas of memory required by Emergency BASIC: $CE00–$CFFF, the RAM beneath the I/O block, the Kernal ROM, and certain page-3 vectors.

See program listing on page 69.

bug-swatter

• The version of "Skeet" printed in the magazine ("The *GEOS* Column," May 1988) locks up the system when executed from the *GEOS* menu. The *GAZETTE Disk* version doesn't have this problem. The correct version is listed at the end of the program listings. We apologize for any inconvenience.

• The day after the *GAZETTE Disk* was shipped, the author of "Super Printer Driver" ("The *GEOS* Column," this issue) told us about a bug he had found in his program. The Gemini printer driver does not work with *GEOS* 1.2. The version of Super Printer Driver listed in this issue has been corrected. Only the version on the *GAZETTE Disk* is incorrect. To correct the disk version, change line 1070 in the file, PR CUSTOMIZER as follows:

```
AS 1070 POKE254,120:POKE253,4:
        POKE780,253:POKE782,12
        7:POKE781,64:SYS65496
```

Also, lines 121–125 must be added.

```
RR 121 POKE31548,45:POKE31549,
       127:POKE31638,45:POKE31
       639,127
GD 122 POKE31650,54:POKE31651,
       127:POKE30793,63
EQ 123 FOR I=0 TO 17:READ A:PO
       KE(32557+I),A:NEXT
GC 124 DATA 32,95,194,32,93,19
       3,76,92,194
RM 125 DATA 32,95,194,32,99,19
       3,76,92,194
```

• "Speed File for the 64" (April) has a problem with its print routine. It will not print to Commodore 1525, 1526, MPS-801, and MPS-803 printers. We've found, however, that it will print to several 1525 compatibles, including the Star Gemini II and the Commodore MPS-1200, as well as the Diablo 630. We don't know yet why the print routine of Speed File is quirky, but we're doing some detective work and hope to have a solution in this column next month.

So you can code circles around the pros, eh? Well, here's your chance to prove it. It's the GEOS Programming Contest. And all it takes to win is a Commodore and your skill at programming under GEOS to win in any four categories and walk away with all kinds of prizes.

Including a check for $1,000.

Just send us the GEOS-based program you're most proud of—on disk—by August 31, 1988. There are four categories, each with an Applications[1] and Desk Accessories[2] winner. Which means that there are eight first prizes. Eight second prizes. And eight thirds.

And each prize consists of lots more prizes.

YOU WRITE THE PROGRAM, WE'LL WRITE THE CHECKS.

The GEOS Programming Contest.

We may not be the only ones writing checks.

And that's only where the bucks start. Because if your program makes it into a GEOS Shareware Library, all kinds of satisfied users may be writing you checks.

So boot up and get down to pumping out your most professional GEOS program. Then send it in with the information required below. Who knows? We could be sending a check right back to you.

1. Applications are identified by the GEOS Application File Type, are entered from and exit to the deskTop and conform to the GEOS user interface.
2. Desk Accessories are defined as programs which are less complex than applications, are identified by the GEOS Desk Accessory File Type, may be entered and pop-up within any application and upon exiting return the application to its prior state.

Categories

ENTERTAINMENT—Includes entertainment and games. For example, a Chess game (Applications Division) or a trivia game (Desk Accessories Division).

EDUCATION—Primarily educational and instructional. For example, a world geography program (Applications Division) or a flash card program (Desk Accessories Division).

PRODUCTIVITY—Designs that improve personal productivity. Examples include an "outline processor" (Applications Division) or a scientific or financial calculator (Desk Accessories Division).

OPEN PROGRAMMING—Open design category that includes programs not covered in other categories. Examples include disk utilities, printer and input drivers and telecommunications programs.

Over $25,000 in cash and prizes!

Eight First Prizes!
- $1,000 cash
- Announcement in Compute!'s Gazette Magazine
- Complete library of C64 or C128 GEOS applications from Berkeley Softworks
- Commodore peripherals: 1670 1200 Baud Modem, 1351 Mouse and 1764 or 1750 RAM Expansion Module
- Six month subscription to Q-Link, the telecommunications service and Q-Link's Public Domain Software Library from Quantum Computer Services
- Twelve month subscription to Compute!'s Gazette magazine

Eight Second Prizes!
- Announcement in Compute!'s Gazette Magazine
- Complete library of C64 or C128 GEOS applications from Berkeley Softworks
- Commodore peripherals: 1670 1200 Baud Modem and your choice of a 1764 or 1750 RAM Expansion Module or 1351 Mouse
- Three month subscription to Q-Link, the telecommunications service and Q-Link's Public Domain Software Library from Quantum Computer Services
- Twelve month subscription to Compute!'s Gazette magazine

Eight Third Prizes!
- Announcement in Compute!'s Gazette Magazine
- Your choice of any five C64 or C128 GEOS applications from Berkeley Softworks
- Commodore peripherals: 1670 1200 Baud Modem and your choice of a 1764 or 1750 RAM Expansion Module or 1351 Mouse
- Three month subscription to Q-Link, the telecommunications service and Q-Link's Public Domain Software Library from Quantum Computer Services
- Twelve month subscription to Compute!'s Gazette magazine

Official Rules

1. Employees of Berkeley Softworks, Quantum Computer Services, Laser Direct, Compute!'s Gazette Magazine, their advertising and promotional agencies and their immediate families are not eligible to enter the contest.

2. Each entry must be your original work, previously unpublished in any form. All those programs accepted will be required to affirm this in writing.

3. Contestants may enter multiple categories, but may only submit one entry per category per division (e.g. one entry in the Entertainment category Applications Division, *and* one entry in the Entertainment Desk Accessories Division). Regardless of the number of categories you enter, you will only be eligible to win one prize.

4. Deadline for entries is August 31, 1988. Mail entries to Compute!'s Gazette, P.O. Box 5406, Greensboro, NC, 27403 Attn: GEOS Programming Contest.

5. Acceptance of an entry shall not create any implication that the entry has been received and reviewed by Berkeley Softworks or has been used in any way in product development.

6. Judging will be performed by the staff of Compute!'s Gazette Magazine. The decisions of the judges are final in all respects. This includes decisions regarding creativity, similarity among entries and general suitability.

7. Entries become the property of Berkeley Softworks, which reserves the right to adapt, use or publish all entries received. Entries may become part of a "shareware" library to be distributed by Berkeley Softworks, Compute!'s Gazette and Quantum Computer Services. As part of each submission, contestants should include *in* the program their name, address and a "user fee" amount for satisfied users to send a discretionary payment.

8. Entries may be written in any programming language but must be a GEOS based program supporting the GEOS file structure and be executable from the GEOS deskTop or a GEOS application. Whichever language is chosen, the code must be a self-standing program that can be run by someone who does not own the language. We must be able to legally distribute the program without incurring licensing fees or any other obligations to the maker of the language.

9. Entries must be submitted on 5.25" floppy disks in 1541/1571 format. The following should be clearly marked on both the printout and the disk:
A. Contestant's name, address and phone number.
B. Category and division for the entry.
C. Intended use for the program.

10. Entries must be accompanied by a description which explains how to use the program and what it does.

11. This contest is void where prohibited by law. All federal, state and local taxes are the sole responsibility of the winners.

General Conditions

- Entries will be judged on creativity, originality, interface consistency with other GEOS programs and error-free quality of the code.
- Make sure your mailer will protect your disk from damage. Affix sufficient first class postage. Mail your printout, disk and official entry blank to the above address in time to reach Compute!'s Gazette Magazine before the August 31, 1988, deadline.
- Winners will be announced by October, 1988.

Sponsored by Berkeley Softworks and Compute!'s Gazette.

PLEASE PRINT

Name _____

Phone _____

Address _____

_____

City _____

State _____ Zip _____

Age _____

EVERY CONTEST ENTRY MUST INCLUDE THIS SIGNED FORM

I warrant that the program presently entitled is my own original work and that the work has not been submitted for consideration elsewhere, nor has it been previously published in any form. If my work is accepted by you, I understand that your decision as to the selection of winners and awarding of prizes is final and without recourse on my part. I understand that by entering this contest, my entry becomes the property of Berkeley Softworks and in the event my program is included in a shareware library, I will be required to sign a standard release agreement. (If you are under 18, your parent or legal guardian must sign for you.)

Signature _____

Berkeley Softworks

The brightest minds are working with Berkeley.

Invasion of Europe

Avalon Hill has released *Under Fire* for the Commodore 64.

The game is set in Europe during World War II and features forces from the United States, Germany, and the Soviet Union. Players have control over paratroopers, engineers, mountain troops, assault guns, tanks, and weapons such as machine guns, bazookas, and grenades. There are nine scenarios to choose from, and users can build their own scenarios with the construction set.

The program contains a tutorial to help first-time players get involved quickly.

Suggested retail price is $34.95. A joystick is optional, and a Mapmaker disk is available for $25.

The Avalon Hill Game Company, 4517 Harford Rd., Baltimore, MD 21214

Circle Reader Service Number 200.

Super 81 for the 64

Following the release of the Commodore 128 version of *Super 81 Utilities*, Free Spirit Software has announced that, due to consumer demand, it is releasing the program for the Commodore 64.

Super 81 Utilities copies whole disks or files from 1541 or 1571 drives to the 1581 disk drive. The program also backs up disks or files with one or two 1541 drives, one or two 1571 drives, one or two 1581 drives, or any combination of drives.

Features include a sector editor, partitioning utilities, scratch and unscratch file utilities, lock and unlock file utilities, rename file, format, and direct DOS-command utilities.

The program is available on both 5¼- and 3½-inch formats and boots on either device 8 or 9. The suggested retail price is $39.95.

Free Spirit Software, 905 W. Hillgrove, Suite 6, La Grange, IL 60525

Circle Reader Service Number 201.

Four for the 64

Electronic Arts has released four new software titles from Datasoft, one of its affiliated lables.

In the *Rubicon Alliance*, players must protect the eight planets of the Hyturian Star System from the pirate planet of Nono. There are eight missions to complete, with each having a specific goal and time limit. The suggested retail price is $19.95.

BattleDroidz features a series of war zones that are divided into five levels of difficulty. Players must maneuver their three remote-controlled silicon and steel fighters while trying to capture the energy keys that unlock the entrance to the next zone. The object of the game is to complete a horizontal line of war zones. The suggested retail price for *BattleDroidz* is $24.95.

Global Commander has players assuming the role of the top government official of the United Nuclear Nation. He or she is responsible for the earth's economics, détente, resources, food supplies, and communication. The commander is also responsible for the distribution of all nuclear missiles. The object of the game is to maintain world peace by using intelligence and diplomacy. Weekly status reports rate the player's performance. *Global Commander* retails for $19.95.

In *Tobruk*, players battle Major General Rommel and his forces for control of the Libyan port city of Tobruk. The battle can take place both on the ground and in the air. Action can be controlled from tactical maps or directly in land and air battles. The suggested retail price for *Tobruk* is $19.95.

Electronic Arts, 1829 Gateway Dr., San Mateo, CA 94404

Circle Reader Service Number 202.

Free Software

Verbatim is offering personal-computer users a free software program each time they purchase a specially marked box of Verbatim's Bonus disks from now through December 1988.

Disk purchasers can choose from *Sinbad's Gammon*, a backgammon game; *Investicalc*, a financial calculation program; and *Banner Maker*, which prints message banners for parties and special events. The three programs are available for the Commodore 64, the IBM PC and compatibles, and the Apple IIe and IIc.

To receive the software, buyers must mail the coupon inside the specially marked ten-packs of Bonus 5¼-inch single-sided/double-density, double-sided/double-density, and double-sided/high-density disks along with $1 for shipping and handling. No proof of purchase is necessary. The suggested retail price of each ten-pack is $9.25, $10, and $23, respectively.

There are no quantity limitations, allowing buyers of multiple boxes to send for an equivalent number of software programs.

Verbatim, Marketing Department, 1200 W.T. Harris Blvd., Charlotte, NC 28213

Circle Reader Service Number 203.

Nine Free Spirited Adventures

Free Spirit Software has released nine new text adventure games on three disks for the Commodore 64.

Eye of the Inca features four text games. In the title game, players search for a diamond in an ancient temple. Players must survive and escape from a south seas island in *Shipwrecked*. In *Son of Ali Baba*, the player must defeat an evil magician and his army of monsters in Baghdad. The final game on the disk is called *Perils of Darkest Africa*, where players must search for jewels from King Solomon's mines. The four-game disk retails for $19.95.

Free Spirit's other four-game disk includes the title game, *Revenge of the Moon Goddess*. Players travel into the South American jungles in search of the lost City of the Sun and the gold idol of the Moon Goddess. In *Frankenstein's Legacy*, players encounter cadavers, old mansions, cemeteries, werewolves, and the Creature. *Night of the Walking Dead* has players looking for the grave of Aunt Bedilla, where her locket must be found without waking the dead. In the *Sea Phantom*, players encounter ghost ships, sea caves, mansions, and a restless spirit while traveling the Atlantic. The suggested retail price for the four-game disk is $19.95.

In *Three Hours to Live*, a science-fiction text adventure, players must escape an alien maze filled with poison air in three hours or less to survive. It retails for $9.95.

Free Spirit Software, 905 W. Hillgrove, Suite 6, La Grange, IL 60525

Circle Reader Service Number 204.

Musical Zippers

Larry Cotton

Try your ear at identifying two tunes played at the same time with this clever musical pastime. There are three variations to entertain you and test your musical detective skills. For the 64.

Musical zippers occur when two tunes play simultaneously with each tune's notes alternating with the other tune's notes. The notes are played in this order: first note of first tune, first note of second tune, second note of first tune, second note of second tune, and so on.

When the zipper is closed, the two tunes play in essentially the same pitch, and they're almost impossible to identify.

However, as the zipper starts to open, the tunes gradually begin to play in different pitches; one tune plays in a higher range, the other in a lower range. As the zipper opens further, and the pitch ranges become sufficiently different, identifying the two tunes becomes relatively easy.

"Musical Zippers" consists of three programs that demonstrate this phenomenon. The first, Zipper 1, plays two simple, well-known tunes. The zipper is closed for the first playing, as illustrated on the screen. On subsequent playings, the zipper gradually opens and the tunes become identifiable.

Zipper 2 asks the user to open the zipper by pressing the space bar. Holding the space bar will open the zipper further. Additionally, each tune can be heard without interference from the other by pressing and holding U to hear the upper one or L to hear the lower one. Try to guess what the tunes are before pressing U or L.

Zipper 3 allows either voice to be heard above the other, depending on whether the + or − key is pressed. The "distance apart" shown on the screen is actually the value of the frequency multiplication and division factor. When it's zero, the two tunes are playing in the same key and are close to the same range. Either tune can be heard separately by pressing 1 or 2.

After you you've recognized what tunes are playing, it's often possible to identify them even with the zipper closed.

See program listings on page 73.

LET'S FACE IT—MAIL ORDER HOUSES ARE *NOT* ALL THE SAME!

SOFTWARE SUPPORT INTERNATIONAL

CONVENIENCE—FAST SERVICE—RELIABILITY—SUPPORT

During the inception of Software Support International, we examined the customer support policies of many Commodore mail order houses. One thing became quite evident: *MAIL ORDER HOUSES ARE NOT ALL THE SAME!!* Software Support International has developed customer support policies you can relate to.

***CONVENIENCE:** Our toll free order line, for instance, saves you money and adds the convenience of finger tip shopping. After hours order lines are provided for late night or early morning shopping.

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***SUPPORT:** Our technical support line is manned by some of the most knowledgable Commodore experts around.

Our catalog, listing detailed information on our products as well as hundreds of others, is mailed automatically to our regular custmers. If you have never ordered from us, but would like to see why thousands of fellow Commodore users have chosen us as their main source of software and accessories, simply pick up the phone and give us a call, or drop us a line requesting our Spring/Summer 1988 catalog. Remember, our business is **SOFTWARE SUPPORT!**

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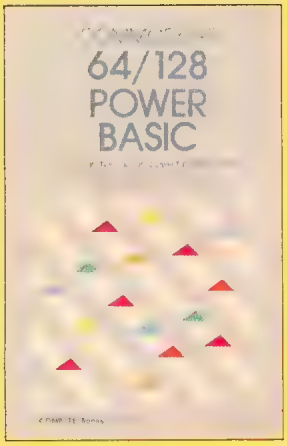

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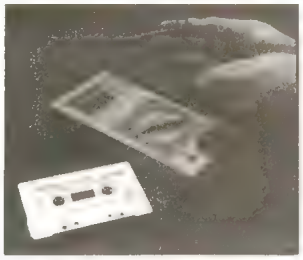

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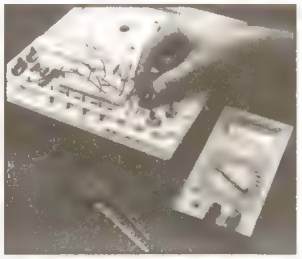
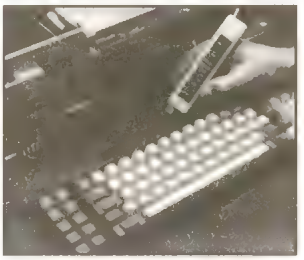
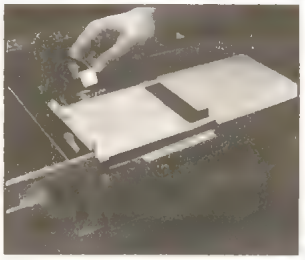


You'll set up and perform electronics experiments and demonstrations using your NRI Discovery Lab®. You'll even interface the lab with your computer to "see" keyboard-generated data.



After you build this digital logic probe, you'll explore the operation of the Sanyo detached "intelligent" keyboard and its dedicated microprocessor.



Next, you install the disk drive. You learn disk drive operation and adjustment, make a copy of the MS-DOS operating disk, and begin your exploration of the 8088 CPU.

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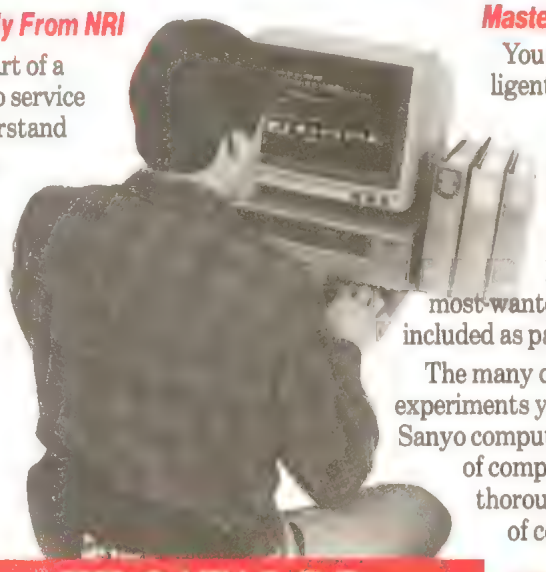

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BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Error Analyzer

Article on page 59.

Program 1: ERROR.BOOT

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
      ALL RIGHTS RESERVED
HD 20 PRINT"{CLR}{2 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC."
CA 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED"
JX 40 PRINT"{2 DOWN}LOADING IN
      AT LOCATION";
KM 50 NU=PEEK(55)+256*PEEK(56)
      -742:GOSUB280
AX 60 PRINTNU;:PRINT"{LEFT}.":
      POKE55,LO:POKE56,HI:CLR
GQ 70 SA=PEEK(55)+256*PEEK(56)
      :ADR=SA
SR 80 OPEN15,8,15:Z$=CHR$(0)
ED 90 OPEN2,8,2,"ERROR.OBJ,P,R
      "
GC 100 INPUT#15,E,E$:IFE>0THEN
       PRINT"DISK ERROR: "E$:C
       LOSE2:CLOSE15:END
SH 110 GET#2,A$,A$:REM GET STA
       RT ADDRESS
BS 120 GET#2,A$,B$:A$=A$+Z$:B$
       =B$+Z$
CS 130 POKEADR,ASC(A$):POKEADR
       +1,ASC(B$)
BS 140 IFADR=SA+740THEN160
KG 150 ADR=ADR+2:GOTO120
HG 160 CLOSE2:CLOSE15:PRINT"OK
       "
SH 170 PRINT"{DOWN}RELOCATING.
       .. ";
QM 180 FORA=1TO10:GOSUB270:GOS
       UB290
SS 190 HEX=HEX+4:GOSUB320:NEXT
AX 200 FORA=1TO12:GOSUB270:GOS
       UB290:NEXT
HJ 210 FORA=606+SATO630+SASTEP
       2
HG 220 HEX=A-1:GOSUB290:NEXT:H
       EX=155+SA
AC 230 GOSUB320:HE=658+SA:LO=P
       EEK(HE+1)
EG 240 HI=PEEK(HE+6):NU=LO+256
       *HI+SA
QF 250 GOSUB280:POKEHE+1,LO:PO
       KEHE+6,HI
XD 260 PRINT"DONE":SYSSA:END
QP 270 READHE:HE=HE+SA:RETURN
MH 280 HI=INT(NU/256):LO=NU-HI
       *256:RETURN
CM 290 NU=PEEK(HE+1)+256*PEEK(
       HE+2)+SA
FA 300 GOSUB280:POKEHE+1,LO:PO
       KEHE+2,HI
PK 310 RETURN
EX 320 NU=PEEK(HE)+256*PEEK(HE
       +2)+SA
EJ 330 GOSUB280:POKEHE,LO:POKE
       HE+2,HI
HP 340 RETURN
AS 350 DATA 166,180,208,229,24
       9,269,289
BA 360 DATA 309,337,357,36,39,
       56,61,72,78
DX 370 DATA 132,639,649,655,70
       3,709
```

Program 2: ERROR.OBJ

See instructions in article on page 59 before typing in.

```
C000:A5 01 29 02 F0 09 A5 01 D1
C008:29 FE 48 A9 FF D0 08 A5 7A
C010:01 D0 F7 8A 7B 6C 6C A2 F6
C018:20 A0 00 B9 00 A0 99 00 23
C020:A0 C8 D0 F7 EE 1D 00 EE 98
C028:20 00 CA D0 EE 68 85 01 45
C030:A2 00 A5 FB 48 A5 FC 48 92
C038:BD 44 02 85 FB BD 45 02 A5
C040:85 FC A9 4C A0 00 91 FB E1
C048:BD 5E 02 C8 91 FB BD 5F 64
C050:02 C8 91 FB E8 E8 E0 1A BD
C058:D0 DE A9 05 8D 8F B7 68 02
C060:85 FC 68 85 FB 60 D3 41 93
C068:4E 4A 4F 59 20 C4 41 53 0D
C070:47 55 50 54 41 20 39 2F 66
C078:38 37 A0 00 D1 7A D0 03 15
C080:4C 73 00 48 20 72 01 68 BE
C088:C9 B2 F0 15 C9 A5 D0 07 98
C090:A9 46 20 D2 FF A9 4E 20 0D
C098:D2 FF A9 7C A0 01 20 1E E7
C0A0:AB 4C 08 AF 90 0E 20 72 76
C0A8:01 A9 86 A0 01 20 1E AB 60
C0B0:A9 FF D0 0A 20 72 01 A9 38
C0B8:96 A0 01 20 1E AB A2 16 CA
C0C0:4C 37 A4 0A 69 3A B0 08 09
C0C8:85 22 BA E4 22 90 01 60 F0
C0D0:20 72 01 A9 AC A0 01 20 C3
C0D8:1E AB 4C 35 A4 20 5B BC 4A
C0E0:D0 03 4C 9B BC 20 72 01 1B
C0E8:A9 BF A0 01 20 1E AB 4C 70
C0F0:48 B2 A5 66 30 03 4C BF 44
C0F8:B1 20 72 01 A9 D7 A0 01 A8
C100:20 1E AB 4C 48 B2 A6 64 14
C108:D0 03 4C A8 B7 20 72 01 EC
C110:A9 E8 A0 01 20 1E AB 4C E3
C118:48 B2 C9 3A D0 03 4C E1 56
C120:A7 20 72 01 A9 FE A0 01 69
C128:20 1E AB 4C 08 AF C9 29 39
C130:D0 03 4C 06 AB 20 72 01 8A
C138:A9 0F A0 02 20 1E AB 4C A5
C140:08 AF 20 79 00 D0 DA 4C 94
C148:49 B4 C5 4D 90 03 4C CF 24
C150:AD 20 72 01 A9 19 A0 02 06
C158:20 1E AB 4C 30 AE A5 10 45
C160:D0 03 4C CC B0 20 72 01 4F
C168:A9 2D A0 02 20 1E AB 4C 5D
C170:08 AF 20 CC FF A9 00 85 E0
C178:13 4C D7 AA 20 45 58 50 55
C180:45 43 54 45 44 00 53 54 73
C188:52 49 4E 47 20 45 58 50 DC
C190:45 43 54 45 44 00 4E 55 7A
C198:4D 45 52 49 43 20 54 59 8F
C1A0:50 45 20 45 58 50 45 43 C7
C1A8:54 45 44 00 4F 55 54 20 C8
C1B0:4F 46 20 53 54 41 43 4B 20
C1B8:20 53 50 41 43 45 00 4D BB
C1C0:55 53 54 20 42 45 20 2D E4
C1C8:33 32 37 36 38 20 54 4F F6
C1D0:20 33 32 37 36 37 00 4D C6
C1D8:55 53 54 20 42 45 20 50 20
C1E0:4F 53 49 54 49 56 45 00 7D
C1E8:4D 55 53 54 20 42 45 20 CC
C1F0:4C 45 53 53 20 54 48 41 AF
C1F8:4E 20 32 35 36 00 45 58 D9
C200:54 52 41 20 43 48 41 52 7E
C208:41 43 54 45 52 53 00 4D 0B
C210:49 53 53 49 4E 47 20 29 07
C218:00 4F 50 45 52 41 54 4F 5F
C220:52 20 55 53 45 44 20 54 86
C228:57 49 43 45 00 25 20 56 93
C230:41 52 49 41 42 4C 45 53 49
C238:20 44 49 53 41 4C 4C 4F 60
C240:57 45 44 00 FF AE 9B AD EA
C248:FB A3 C9 B1 BB B1 A4 B7 AE
C250:07 A8 02 AB 41 B4 CB AD A0
C258:C8 B0 71 A4 51 A8 7A 00 09
C260:A4 00 C3 00 DD 00 F2 00 85
C268:06 01 1A 01 2E 01 42 01 7F
C270:4A 01 5E 01 78 02 D8 02 B6
C278:20 C2 BD A0 00 B1 7A 30 C9
C280:B9 02 A9 01 91 7A AD 06 80
C288:03 8D CF 02 AD 07 03 8D 2A
C290:D0 02 A9 AA 8D 06 03 A9 13
C298:02 8D 07 03 A5 39 85 14 C4
C2A0:A5 3A 85 15 20 13 A6 20 44
C2A8:C9 A6 08 C9 01 D0 1E E6 C8
C2B0:C7 A9 2A 20 D2 FF C6 C7 B7
C2B8:A9 2A 91 5F 88 24 0F AD 66
C2C0:CF 02 8D 06 03 AD D0 02 33
C2C8:8D 07 03 A9 00 28 4C 1A 25
C2D0:A7 00 4C F3 A6 4C 24 A7 49
C2D8:20 1E AB A4 3A C8 F0 03 8F
C2E0:20 C2 BD 4C 74 A4 00 00 D9
```

Emergency BASIC

See instructions in article on page 62 before typing in.

```
0801:0B 08 0A 00 9E 32 30 36 2E
0809:34 00 00 00 00 00 00 A0 D3
0811:00 B9 CC 08 99 00 CE B9 CD
0819:CC 09 99 00 CF C8 D0 F1 3A
0821:B9 30 08 F0 06 20 D2 FF 80
0829:C8 D0 F5 20 00 CE 60 0D 9B
0831:20 45 4D 45 52 47 45 4E 29
0839:43 59 20 44 49 52 45 43 EA
0841:54 20 4D 4F 44 45 20 49 E2
0849:53 20 41 56 41 49 4C 41 A1
0851:42 4C 45 0D 20 42 59 20 EB
0859:50 52 45 53 53 49 4E 47 A7
0861:20 5B 43 4F 4E 54 52 4F 6D
0869:4C 5D 5B 52 45 53 54 4F F6
0871:52 45 5D 2E 0D 0D 20 46 AD
0879:52 4F 4D 20 45 4D 45 52 6E
0881:47 45 4E 43 59 20 44 49 A1
0889:52 45 43 54 20 4D 4F 44 DA
0891:45 2C 20 50 52 45 53 53 F9
0899:0D 20 5B 43 4F 4E 54 52 86
08A1:4F 4C 5D 5B 52 45 53 54 70
08A9:4F 52 45 5D 20 54 4F 20 85
08B1:52 45 54 55 52 4E 20 54 7C
08B9:4F 0D 20 59 4F 55 52 20 E2
08C1:50 52 4F 47 52 41 4D 2E 4D
08C9:0D 0D 00 78 20 8A FF 58 AE
08D1:AD 00 03 8D 5E CE 8D 2F 6A
08D9:CF AD 01 03 8D 5F CE 8D A2
08E1:30 CF AD 26 03 8D 70 CE 14
08E9:8D 1B CF 8D 3E CF AD 27 0E
08F1:03 8D 71 CE 8D 1C CF 8D 0C
08F9:3F CF AD 18 03 8D 0C CF 0B
0901:8D C6 CF AD 19 03 8D 0D 5D
0909:CF 8D C7 CF A9 4C 8D 00 F5
0911:03 A9 CE 8D 01 03 60 48 DE
0919:A9 00 8D F5 CF A9 60 8D 84
0921:26 03 A9 CE 8D 27 03 68 A0
0929:4C 00 00 08 78 48 A9 72 8C
0931:8D 18 03 A9 CE 8D 19 03 EC
0939:68 28 4C 00 00 78 48 8A 10
0941:48 98 48 AD F5 CF F0 03 55
0949:4C 06 CF 20 E3 CF C9 FB EC
0951:F0 03 4C 06 CF EE F5 CF 7C
0959:20 E3 CF C9 FF D0 F9 A5 E7
0961:01 8D F4 CF AD 00 DD 8D A9
0969:F7 CF A9 30 85 01 A9 00 27
0971:A0 D0 A2 28 20 C8 CF A9 4C
0979:37 85 01 A0 00 B9 00 D8 72
0981:99 00 F8 B9 00 D9 99 00 B5
0989:F9 B9 00 DA 99 00 FA B9 31
0991:00 DB 99 00 FB B9 00 D0 65
0999:99 00 FC C8 D0 DF BA 8E AE
09A1:F3 CF A2 FF 9A 20 84 FF 54
09A9:20 8A FF A2 00 A0 28 18 83
09B1:20 99 FF 20 81 FF A9 0E A9
09B9:8D 26 03 A9 CF 8D 27 03 1D
09C1:58 A9 06 8D 20 D0 8D 86 E9
09C9:02 A9 0E 8D 21 D0 6C 00 07
09D1:A0 68 A8 68 AA 68 4C 00 79
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09D9:00 48 A9 1D 8D 00 03 A9 21
09E1:CF 8D 01 03 68 4C 00 00 04
09E9:48 A9 00 8D F6 CF A9 31 DE
09F1:8D 26 03 A9 CF 8D 27 03 55
09F9:68 4C 00 00 48 A9 40 8D 4A
0A01:18 03 A9 CF 8D 19 03 68 53
0A09:4C 00 00 78 48 AD F6 CF 81
0A11:F0 03 4C C4 CF EE F6 CF 2C
0A19:20 E3 CF C9 FB D0 F3 20 F7
0A21:E3 CF C9 FF D0 F9 A9 30 46
0A29:85 01 A9 D2 A0 02 A2 26 1B
0A31:20 C8 CF A0 00 A9 30 85 18
0A39:01 B9 00 D1 99 00 01 B9 E1
0A41:00 D0 99 00 00 A9 35 85 53
0A49:01 B9 00 F8 99 00 D8 B9 14
0A51:00 F9 99 00 D9 B9 00 FA C7
0A59:99 00 DA B9 00 FB 99 00 54
0A61:DB C8 D0 D1 B9 00 FC 99 2E
0A69:00 D0 C8 C0 2F D0 F5 AD 2D
0A71:11 D0 29 7F 8D 11 D0 AD 5F
0A79:F7 CF 8D 00 DD AD F4 CF 8E
0A81:85 01 AE F3 CF 9A A9 00 E9
0A89:8D F5 CF 68 A8 68 AA 68 07
0A91:4C 00 00 8D D2 CF 8C D5 69
0A99:CF A0 00 B9 00 C0 99 00 8F
0AA1:C0 C8 D0 F7 EE D2 CF EE 33
0AA9:D5 CF CA D0 EE 60 A9 7F CE
0AB1:8D 00 DC AD 01 DC EA EA 3F
0AB9:CD 01 DC D0 F6 60 00 37 0E
0AC1:00 00 00 00 00 00 00 00 D5
```

Bagger

See instructions in article on page 36 before typing in.

Bagger

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0809:37 35 29 3A 12 42 41 47 2E
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0819:00 00 A9 EF 8D 28 03 A9 1A
0821:C1 8D 18 03 A9 0F 8D 18 65
0829:D4 4C 68 15 F4 78 A9 23 15
0831:8D 12 D0 AD 11 D0 29 7F 1F
0839:8D 11 D0 A9 81 8D 1A D0 50
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0849:15 03 58 60 AD 19 D0 8D B6
0851:19 D0 29 01 D0 07 AD 0D 62
0859:DC 58 4C 31 EA AD 12 D0 8D
0861:C9 32 B0 07 A0 57 A2 00 11
0869:4C 8D 08 C9 66 B0 07 A0 45
0871:87 A2 01 4C 8D 08 C9 96 89
0879:B0 07 A0 B7 A2 02 4C 8D 76
0881:08 C9 C6 B0 DB A0 23 A2 36
0889:03 4C 8D 08 8C 12 D0 8E 3D
0891:41 09 8A 0A 0A 0A 8D 42 4C
0899:09 AA A0 00 A9 80 8D 10 67
08A1:D0 8D 17 D0 A9 FF 8D 1C F1
08A9:D0 8D 15 D0 8C 1D D0 BD 6D
08B1:3C 03 99 00 D0 BD 17 09 88
08B9:99 01 D0 C8 C8 E8 C0 10 F8
08C1:D0 ED A0 00 AE 42 09 BD 18
08C9:5C 03 99 F8 07 B9 37 09 22
08D1:99 27 D0 C8 E8 C0 08 D0 4A
08D9:EE AD 3F 09 8D 25 D0 AD 95
08E1:40 09 8D 26 D0 CE 43 09 B9
08E9:AD 43 09 C9 00 D0 21 A9 8E
08F1:8C 8D 43 09 A0 00 B9 7C 99
08F9:03 C9 00 F0 0E B9 5C 03 20
0901:AA B9 7C 03 99 5C 03 8A 65
0909:99 7C 03 C8 C0 20 D0 E6 03
0911:68 A8 68 AA 68 40 3C 3C 32
0919:3C 2D 2D 2D 4A 35 6C 6C 79
0921:6C 5D 5D 5D 7A 65 9C 9C 81
0929:9C 8D 8D 8D AA 95 CC CC 89
0931:CC BD BD BD DA C5 08 08 B2
0939:08 03 01 07 05 02 0A 00 E4
0941:02 10 79 00 4C A0 00 B9 26
0949:54 09 99 3C 03 C8 C0 60 DB
0951:D0 F5 60 00 00 00 00 00 55
0959:00 00 17 00 00 00 00 00 4E
0961:00 00 FF 00 00 00 00 00 73
0969:00 00 FF 00 00 00 00 00 7B
0971:00 00 FF 2D 2D 2D 29 2A F0
0979:2B 2E 2F 2D 2D 2D 2A 2B 03
0981:2C 2E 2F 2D 2D 2D 2B 2C 8E
0989:29 2E 2F 2D 2D 2D 2C 29 14
0991:2A 2E 2F 00 00 00 2B 2C AC
0999:29 00 00 00 00 00 2C 29 C1
09A1:2A 00 00 00 00 00 29 2A 45
09A9:2B 00 00 00 00 00 2A 2B D0
09B1:2C 00 00 7B A9 00 8D DC D6
09B9:02 A2 00 BD 3C 03 C9 00 D2
09C1:F0 07 C9 12 F0 72 DE 3C B3
09C9:03 E8 E0 03 D0 ED A2 00 67
09D1:BD 44 03 C9 00 F0 07 C9 6C
09D9:12 F0 5D DE 44 03 E8 E0 AB
09E1:03 D0 ED A2 00 BD 4C 03 24
09E9:C9 00 F0 07 C9 12 F0 48 30
09F1:DE 4C 03 E8 E0 03 D0 ED 18
09F9:A2 00 BD 54 03 C9 00 F0 8A
0A01:07 C9 12 F0 33 DE 54 03 1D
0A09:E8 E0 03 D0 ED AD DB 02 17
0A11:C9 00 F0 23 A8 88 98 0A FC
0A19:0A 0A A8 A2 00 B9 3C 03 56
0A21:C9 00 F0 09 C8 E8 E0 03 77
0A29:F0 0D 4C 1E 0A A9 FF 99 F4
0A31:3C 03 A9 00 8D DB 02 60 99
0A39:A9 01 8D DC 02 60 F0 00 55
0A41:00 00 00 00 00 00 00 00 55
0A49:00 00 00 00 00 00 00 3C 99
0A51:00 00 FF 00 00 55 00 01 BB
0A59:D7 40 01 55 40 01 7D 40 20
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0A69:AC 3A AA AC 3A EB AC 3A 97
0A71:EB AC 3A EB AC 3A EB AC 7F
0A79:3F AA F0 05 FF 50 90 00 A8
0A81:00 00 00 00 00 00 00 00 95
0A89:00 00 00 00 00 00 00 FF 9D
0A91:00 03 FF C0 00 55 00 00 C7
0A99:D7 00 00 55 00 00 7D 00 E9
0AA1:00 14 00 03 EB C0 0E AA 14
0AA9:B0 0E AA B0 0E EB B0 0E 89
0AB1:EB B0 0E EB B0 0E EB B0 AE
0AB9:0F EB F0 01 FF 40 A0 00 C0
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0AC9:00 00 00 00 00 00 00 3C 1A
0AD1:00 00 FF 00 00 55 C0 01 BD
0AD9:DD C0 01 55 40 01 F5 40 B4
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0AE9:AC 3A AA AC 3A AA AC 3B 14
0AF1:EB EC 3A DB AC 3A E7 AC 07
0AF9:0F AA F0 03 FF C0 90 00 B2
0B01:00 00 00 00 00 00 00 00 17
0B09:00 00 00 00 00 00 00 FF 1F
0B11:00 03 FF C0 00 55 00 00 49
0B19:D7 00 1C 55 00 FC 7D 00 E2
0B21:EC 14 00 EF EB C0 EA AA 94
0B29:B0 FA AA B0 3F AB B0 03 C3
0B31:AB B0 03 AB B0 03 AB B0 FD
0B39:03 AB F0 03 FF 40 90 00 2C
0B41:15 54 00 6A 94 01 55 64 55
0B49:01 AA 64 01 AA 64 01 AA BA
0B51:64 01 AA 64 01 AA 64 01 F1
0B59:AA 64 01 AA 64 01 AA 64 89
0B61:01 55 50 00 00 00 00 00 57
0B69:00 00 00 00 00 00 00 00 7F
0B71:00 00 00 00 00 00 00 00 87
0B79:00 00 00 00 00 00 00 00 8F
0B81:00 00 0A A0 AA 2A 82 A8 8E
0B89:00 40 00 04 01 04 00 40 48
0B91:40 00 00 00 00 00 00 00 C7
0B99:00 00 00 00 00 00 00 00 AF
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0BA9:00 00 00 00 00 00 00 00 BF
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0BB9:00 00 00 00 00 00 00 03 D2
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0BC9:05 50 00 03 50 00 01 50 7B
0BD1:00 00 A0 00 01 98 00 54 BA
0BD9:9A 00 00 9A 00 05 5A 00 AF
0BE1:00 0A 00 00 0F 00 00 0F 02
0BE9:00 00 0F 00 00 0F 00 00 1E
0BF1:0F 00 00 0F 00 00 0F 00 9E
0BF9:00 FF 00 00 00 00 00 00 10
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0C11:00 01 2A 10 01 2A 10 00 80
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0C31:33 00 00 33 00 00 F3 C0 BE
0C39:00 33 00 00 00 00 00 F2 11
0C41:20 D3 0C A9 00 8D DE 02 70
0C49:A2 00 BD 3F 03 C9 00 F0 8E
0C51:07 C9 FF F0 74 FE 3F 03 8F
0C59:E8 E0 03 D0 ED A2 00 BD 43
0C61:47 03 C9 00 F0 07 C9 FF 4E
0C69:F0 5F FE 47 03 E8 E0 03 A6
0C71:D0 ED A2 00 BD 4F 03 C9 BC
0C79:00 F0 07 C9 FF F0 4A FE A2
0C81:4F 03 E8 E0 03 D0 ED A2 07
0C89:00 BD 57 03 C9 00 F0 07 63
0C91:C9 FF F0 35 FE 57 03 E8 44
0C99:E0 03 D0 ED AD DD 02 C9 8E
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0CB9:0D 4C AD 0C A9 01 99 3F A5
0CC1:03 A9 00 8D DD 02 4C CF FD
0CC9:0C A9 01 8D DE 02 20 D3 5E
0CD1:0C 60 A2 00 A0 00 8C 35 AF
0CD9:0D 8C 36 0D 8C 37 0D BD 4C
0CE1:3C 03 D9 3F 03 D0 03 20 89
0CE9:21 0D E8 EE 35 0D AD 35 50
0CF1:0D C9 03 D0 EA CA CA CA 53
0CF9:C8 A9 00 8D 35 0D EE 36 AB
0D01:0D AD 36 0D C9 03 D0 D7 78
0D09:A9 00 8D 36 0D EE 37 0D AC
0D11:AD 37 0D 0A 0A 0A A8 AA 86
0D19:AD 37 0D C9 04 D0 C0 60 5B
0D21:B9 3F 03 C9 00 F0 0B A9 68
0D29:00 99 3F 03 9D 3C 03 EE 94
0D31:E4 02 60 00 00 00 04 A9 FB
0D39:00 8D E0 02 8D E1 02 AD 98
0D41:42 03 C9 00 F0 07 C9 FF AD
0D49:F0 30 EE 42 03 AD 4A 03 50
0D51:C9 00 F0 07 C9 FF F0 22 31
0D59:EE 4A 03 AD 52 03 C9 00 EA
0D61:F0 07 C9 FF F0 14 EE 52 F6
0D69:03 AD 5A 03 C9 00 F0 10 2C
0D71:C9 FF F0 06 EE 5A 03 4C 22
0D79:81 0D A9 01 8D E0 02 60 31
0D81:AD DF 02 C9 00 F0 30 A8 14
0D89:88 98 0A 0A 0A A8 B9 42 98
0D91:03 C9 00 F0 03 4C B8 0D 76
0D99:98 AA A9 00 8D E5 0D BD BB
0DA1:3F 03 C9 32 90 06 99 42 8A
0DA9:03 4C B8 0D E8 EE E5 0D 1C
0DB1:AD E5 0D C9 03 D0 E8 A0 28
0DB9:00 A2 00 CE D7 02 BD 42 ED
0DC1:03 C9 F5 90 10 98 CD D7 ED
0DC9:02 D0 0A A9 00 9D 42 03 F2
0DD1:A9 01 8D E1 02 C8 98 0A 3F
0DD9:0A 0A AA C0 04 D0 DF EE EE
0DE1:D7 02 60 00 03 03 AD D5 C9
0DE9:02 C9 01 F0 1E C9 02 F0 B3
0DF1:48 C9 03 F0 66 C9 04 F0 65
0DF9:0F C9 05 F0 08 C9 06 F0 22
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0E19:03 D4 A9 00 8D 02 D4 A9 E8
0E21:0A 8D 01 D4 A9 95 8D 00 D1
0E29:D4 A9 41 8D 04 D4 A9 28 0A
0E31:20 1F 0F A9 40 8D 04 D4 B6
0E39:60 A9 84 8D 05 D4 A9 20 48
0E41:8D 06 D4 8D 01 D4 A9 95 5D
0E49:8D 00 D4 A9 81 8D 04 D4 80
0E51:A9 19 20 1F 0F A9 80 8D 2C
0E59:04 D4 60 A9 88 8D 05 D4 AC
0E61:A9 44 A9 88 8D 06 D4 8D DC
0E69:01 D4 A9 95 8D 00 D4 A9 89
0E71:81 8D 04 D4 A9 8C 20 1F 5E
0E79:0F A9 80 8D 04 D4 60 A9 4E
0E81:44 8D 05 D4 8D 06 D4 A2 E1
0E89:00 BD AB 0E 8D 01 D4 BD 43
0E91:AF 0E 8D 00 D4 A9 11 8D B7
0E99:04 D4 A9 1E 20 1F 0F A9 49
0EA1:10 8D 04 D4 E8 E0 04 D0 9A
0EA9:E0 60 B4 4E 96 5A 78 FA D3
0EB1:46 AA A9 44 8D 05 D4 A9 E8
0EB9:88 8D 06 D4 A2 00 BD E0 FC
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0ED1:7D 20 1F 0F A9 20 8D 04 76
0ED9:D4 E8 E0 03 D0 E0 60 0A BB
0EE1:0F 0C 78 FA 46 A9 44 8D 36
0EE9:05 D4 8D 06 D4 A9 AA 8D FF
0EF1:00 D4 AD 1B 0F 18 69 0A 60
0EF9:C9 82 F0 16 8D 1B 0F 8D 9F
0F01:01 D4 A9 11 8D 04 D4 A9 EA
0F09:0A 20 1F 0F A9 10 8D 04 B5
0F11:D4 60 A9 0A 8D 1B 0F 4C CA
0F19:00 0F 3C 02 01 1E 8D 1E 5C
0F21:0F 8E 1C 0F 8C 1D 0F AE 84
0F29:1E 0F A0 00 C8 C0 FF F0 68
0F31:03 4C 2D 0F CA E0 00 F0 45
0F39:03 4C 2B 0F AE 1C 0F AC F2
0F41:1D 0F 60 61 AD D9 02 C9 76
0F49:63 B0 03 4C 54 0F A9 63 FF
0F51:8D D9 02 A9 93 20 D2 FF 4A
0F59:A9 00 8D 20 D0 8D 21 D0 CF
0F61:8D 00 D8 8D 01 D8 A9 90 89
0F69:20 D2 FF A9 00 AE D9 02 57
0F71:20 CD BD AD 01 04 C9 20 71
0F79:D0 10 A9 00 8D 15 10 AD C7
0F81:00 04 8D 01 04 A9 30 8D 17
0F89:00 04 AD 00 04 8D 15 10 EE
0F91:AD 01 04 8D 16 10 A9 93 F7
0F99:20 D2 FF 20 10 18 EA EA 20
0FA1:18 A2 0C A0 0C 20 F0 FF C2
0FA9:A9 0B A0 10 20 1E AB A2 E7
0FB1:00 A0 00 A9 12 85 FB A9 DA
0FB9:D3 85 FD A9 04 85 FC A9 57
0FC1:07 85 FE A9 20 91 FB 91 10
0FC9:FD 18 A5 FB 69 28 85 FB 54
0FD1:A5 FC 69 00 85 FC 38 A5 65
0FD9:FD E9 28 85 FD A5 FE E9 3D
0FE1:00 85 FE AD 15 10 91 FB 24
0FE9:AD 16 10 91 FD 20 1A 10 34
0FF1:A9 06 8D 05 02 8E 17 10 FD
0FF9:8C 18 10 20 E7 0D AE 17 50
1001:10 AC 18 10 E8 E0 0C D0 0C
1009:BA 60 1F 4C 45 56 45 4C A1
1011:05 20 00 00 30 31 0B 00 18
1019:31 8D 19 10 8E 17 10 8C D6
1021:18 10 A2 00 A0 00 C8 C0 FC
1029:23 F0 03 4C 25 10 AD 19 90
1031:FF F0 03 4C 25 10 AD 19 90
1039:10 AE 17 10 AC 18 10 60 37
1041:54 18 AD CA 02 69 C8 02 4D
1049:8D CA 02 AD C9 02 69 00 27
1051:8D C9 02 A0 00 A2 18 18 C7
1059:20 F0 FF A9 92 A0 10 20 B7
1061:1E AB AE CA 02 AD C9 02 5A
1069:20 CD BD A0 18 A2 18 18 62
1071:20 F0 FF A9 9A A0 10 20 10
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1081:0A 90 05 A2 09 8D CB 02 AD
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10B9:E9 01 0A 0A 0A 18 69 07 7B
10C1:AA A9 2F 9D 5C 03 A9 00 A3
10C9:8D 68 11 8D 69 11 4C 49 37
10D1:11 A9 00 8D D8 02 AD 00 E7
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10E1:32 C9 6F F0 49 60 20 55 EB
10E9:11 AD D7 02 C9 01 F0 09 56
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10F9:10 A9 04 8D D7 02 38 E9 07
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1119:02 C9 04 F0 09 EE D7 02 F3
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1129:8D D7 02 4C FF 10 A9 01 A1
1131:8D 68 11 AD D7 02 38 E9 52
1139:01 0A 0A 0A 18 69 07 AA 5F
1141:A9 30 9D 5C 03 4C 54 11 C0
1149:AD D7 02 8D DB 02 A9 01 8C
1151:8D D8 02 60 AD D7 02 38 BF
1159:E9 01 0A 0A 0A 18 69 07 1D
1161:AA A9 FF 9D 3C 03 60 00 CB

1169:00 53 4D 44 54 60 53 60 79
1171:49 60 48 60 6B 60 89 60 AF
1179:CA 60 EA 60 09 60 11 0F 77
1181:F0 00 3F FC 00 7F FE 00 CF
1189:FC 7F 00 F8 1F 00 F8 1F A3
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11A9:80 F0 1F 80 F0 0F 80 F0 E9
11B1:0F 80 FF FF 80 FF FF 00 7F
11B9:FF FE 00 00 00 00 00 00 9B
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11C9:00 FF 00 01 FF 80 03 C3 C7
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11D9:C3 F0 0F FF F0 0F FF F0 B0
11E1:0F C3 F0 0F 81 F0 0F 81 FA
11E9:F0 0F 81 F0 0F 81 F0 0F F6
11F1:81 F0 07 00 E0 02 00 40 41
11F9:00 00 00 00 00 00 FF 00 1C
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1241:00 00 03 FF 80 07 FF C0 A6
1249:0F FF 80 0F 80 00 0F 00 18
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1259:FC 00 0F FE 00 0F FC 00 04
1261:0F 00 00 0F 00 00 0F 00 1C
1269:00 0F 00 00 0F 80 00 0F DA
1271:FF 80 07 FF C0 03 FF 80 29
1279:00 00 00 00 00 00 FF 00 9D
1281:00 00 03 FE 00 07 FF 80 92
1289:0F 87 C0 0F 03 C0 0F 03 5C
1291:C0 0F 87 C0 0F FF 80 0F 5F
1299:FF 00 0F F0 00 0F F8 00 DC
12A1:0F FC 00 0F BE 00 0F 9F 31
12A9:00 0F 8F 80 0F 87 C0 0F B2
12B1:83 C0 07 83 C0 03 01 80 75
12B9:00 00 00 00 00 00 FF A9 87
12C1:05 8D 20 D0 A9 06 8D 21 7E
12C9:D0 A9 00 8D 7F 13 A9 ED 23
12D1:A0 12 20 1E AB A9 EE A0 33
12D9:12 20 1E AB EE 7F 13 AD D6
12E1:7F 13 C9 03 D0 EF A9 13 A0
12E9:20 D2 FF 60 93 11 11 12 ED
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12F9:20 20 20 20 20 20 20 20 1E
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1309:20 20 20 20 20 20 20 20 2F
1311:DF 0D 12 20 20 20 20 20 90
1319:20 20 20 20 20 20 20 20 3F
1321:20 20 20 20 20 20 20 20 47
1329:20 20 20 20 20 20 20 20 4F
1331:20 20 20 DF 0D 12 05 B4 E0
1339:B4 B4 B4 B4 B4 B4 B4 B4 5F
1341:B4 B4 B4 B4 B4 B4 B4 B4 67
1349:B4 B4 B4 B4 B4 B4 B4 B4 6F
1351:B4 B4 B4 B4 B4 B4 B4 AA 6D
1359:0D 12 05 B4 B4 B4 B4 B4 0D
1361:B4 B4 B4 B4 B4 B4 B4 B4 87
1369:B4 B4 B4 B4 B4 B4 B4 B4 8F
1371:B4 B4 B4 B4 B4 B4 B4 B4 97
1379:B4 B4 B4 AA 0D 00 03 62 39
1381:A0 00 B9 80 11 99 00 30 56
1389:C8 C0 C1 D0 F5 A0 00 B9 75
1391:40 12 99 C0 30 C8 C0 31 43
1399:D0 F5 A9 93 20 D2 FF A2 03
13A1:00 A9 A0 9D 58 06 A9 01 4F
13A9:9D 58 DA E8 E0 50 D0 F1 7A
13B1:A9 FF 8D 1C D0 A9 00 8D DA
13B9:2E D0 A9 03 8D 27 D0 A9 E4
13C1:0A 8D 25 D0 A9 00 8D 26 90
13C9:D0 A9 00 8D 20 D0 A9 06 39
13D1:8D 21 D0 8D 00 D0 A9 82 13
13D9:A2 01 E0 0D F0 11 CA A9 89
13E1:E7 9D 02 D0 E8 A9 82 9D 41
13E9:02 D0 E8 E8 4C DB 13 A9 92
13F1:FF 8D 0E D0 A9 82 8D 0F CB
13F9:D0 A2 00 8E 10 D0 8E 00 FA
1401:D0 A9 2D E0 07 F0 0C 9D 61
1409:F9 07 E8 A9 09 9D 27 D0 85

1411:4C 02 14 A9 80 8D 15 D0 32
1419:A9 02 8D 64 15 A2 00 8E 50
1421:66 15 8E 65 15 A9 30 8D 27
1429:FF 07 A9 C8 8D 60 15 20 0D
1431:27 15 A9 2F 8D FF 07 A9 7E
1439:02 8D D5 02 20 E7 0D AD 09
1441:15 D0 0D 64 15 8D 15 D0 E9
1449:AD 64 15 2A 8D 64 15 AE 7D
1451:65 15 DE 02 D0 BD 02 D0 BF
1459:AE 66 15 DD 53 15 F0 0B CE
1461:A9 01 8D 60 15 20 27 15 E2
1469:4C 50 14 EE 65 15 EE 65 FF
1471:15 EE 66 15 AD 66 15 C9 F8
1479:06 F0 03 4C 26 14 A9 2A 05
1481:8D F8 07 A9 95 8D 01 D0 DF
1489:A9 00 8D 00 D0 A9 FF 8D F2
1491:15 D0 A9 04 8D D5 02 20 D5
1499:E7 0D A2 00 EE 00 D0 A9 10
14A1:0A 8D 60 15 20 27 15 AD 05
14A9:00 D0 DD 53 15 F0 03 4C B5
14B1:9D 14 BD 59 15 9D F9 07 15
14B9:E8 E0 06 F0 03 4C 9D 14 F6
14C1:A9 0A 8D 60 15 20 27 15 85
14C9:EE 00 D0 AD 00 D0 C9 00 35
14D1:F0 07 C9 FF D0 EA 20 1E FD
14D9:15 A0 C8 A9 01 8D 10 D0 97
14E1:20 27 15 EE 00 D0 AD 00 14
14E9:D0 C9 78 F0 03 4C E1 14 2C
14F1:A2 01 E0 07 F0 07 DE 27 C0
14F9:D0 E8 4C F3 14 A9 14 8D 8A
1501:60 15 20 27 15 88 C0 00 63
1509:F0 03 4C F1 14 A9 FF 8D E9
1511:60 15 20 27 15 A9 00 8D 04
1519:15 D0 4C 9B 13 A9 05 8D 1C
1521:D5 02 20 E7 0D 60 8D 61 9F
1529:15 8C 63 15 8E 62 15 AE 95
1531:60 15 A0 00 A5 91 C9 7F 6B
1539:D0 03 68 68 60 C8 C0 FF C7
1541:D0 FB CA E0 00 D0 EB AD 03
1549:61 15 AE 62 15 AC 63 15 9C
1551:60 60 32 4B 64 7D 96 AF B4
1559:C0 C1 C2 C2 C3 C4 C5 01 96
1561:01 01 81 0B 02 01 A5 20 AC
1569:81 13 20 2E 08 A9 00 8D 74
1571:15 D0 A9 00 8D C9 02 8D B4
1579:CA 02 A9 04 8D CB 02 A9 48
1581:0A 8D E5 17 A9 05 8D E6 A5
1589:17 A9 00 8D E4 02 20 46 38
1591:09 A9 FF 8D 43 03 A9 01 FD
1599:8D D9 02 20 45 0F A9 96 93
15A1:20 14 17 20 46 09 A9 01 70
15A9:8D D7 02 A9 17 8D 43 03 E3
15B1:20 C0 12 A9 0A 20 14 17 09
15B9:A9 02 8D E3 17 8D E4 17 F8
15C1:A9 00 8D C8 02 20 42 10 24
15C9:A9 32 20 14 17 A9 04 8D 8F
15D1:D5 02 20 E7 0D A9 00 8D 86
15D9:DB 02 20 A3 10 A9 00 8D 65
15E1:DE 02 8D E0 02 8D DC 02 BD
15E9:CE E3 17 AD E3 17 C9 00 41
15F1:D0 1D A9 02 8D E3 17 AD F8
15F9:E6 17 C9 01 F0 09 AD E6 94
1601:17 20 14 17 4C 10 16 A9 2D
1609:02 8D E6 17 20 14 17 CE 36
1611:E4 17 AD E4 17 C9 00 D0 2A
1619:08 A9 03 8D E4 17 20 A3 54
1621:10 AD DB 02 C9 00 F0 10 9C
1629:20 56 17 AD E1 17 C9 00 B7
1631:F0 06 8D D5 02 20 E7 0D D3
1639:20 B5 09 A9 00 8D DB 02 8E
1641:20 81 17 8D DF 02 20 38 19
1649:0D AD E1 02 C9 01 F0 0F 07
1651:A9 00 8D DF 02 20 38 0D 10
1659:AD E1 02 C9 01 D0 10 A9 C6
1661:04 8D D5 02 20 E7 0D A9 32
1669:14 8D C8 02 20 42 10 AD 14
1671:E4 02 CD E5 17 D0 03 4C F6
1679:92 17 20 81 17 C9 00 8D 3E
1681:DD 02 AD E4 02 8D E0 17 40
1689:20 41 0C A9 00 8D DD 02 26
1691:AD E4 02 CD E0 17 F0 08 38
1699:A9 05 8D C8 02 20 42 10 3F
16A1:AD DC 02 C9 01 F0 29 AD 84
16A9:DE 02 C9 01 F0 27 AD E0 6F
16B1:02 C9 01 F0 1B AD 8D 02 2D
```

```
16B9:29 01 C9 01 D0 03 4C B6 E5
16C1:16 A5 91 C9 7F D0 03 4C C2
16C9:CE 16 4C E9 15 4C 6E 15 D6
16D1:A9 03 4C D8 16 A9 05 8D 99
16D9:D5 02 20 E7 0D A9 C8 20 B4
16E1:14 17 20 46 09 CE CB 02 63
16E9:AD CB 02 C9 00 F0 03 4C D2
16F1:A4 15 A9 E7 A0 17 20 1E 29
16F9:AB A9 FF 20 14 17 4C 6E 6C
1701:15 78 A9 00 8D 1A D0 A9 2D
1709:31 8D 14 03 A9 EA 8D 15 0F
1711:03 58 60 8D DC 17 8C DB F3
1719:17 8E DA 17 A8 A9 FF 8D BC
1721:DD 17 8D DE 17 8D DF 17 69
1729:CE DD 17 AD DD 17 C9 00 D2
1731:D0 F6 CE DE 17 AD DE 17 91
1739:C9 00 D0 F6 CE DF 17 AD A7
1741:DF 17 C9 00 D0 F6 88 C0 92
1749:00 D0 D2 AD DC 17 AC DB 59
1751:17 AE DA 17 60 AC D7 02 EA
1759:88 98 0A 0A 0A A2 00 8E 3D
1761:E1 17 A8 B9 3C 03 C9 00 78
1769:D0 03 EE E1 17 C8 E8 E0 4B
1771:03 D0 F0 AD E1 17 C9 00 4D
1779:F0 05 A9 02 8D E1 17 60 39
1781:20 97 E0 A5 8C C9 00 F0 98
1789:05 C9 05 B0 01 60 A9 00 35
1791:60 20 46 09 A9 FF 8D 43 FC
1799:03 AD E5 17 C9 32 F0 2E 0A
17A1:18 69 14 8D E5 17 EE D9 D4
17A9:02 20 45 0F A9 96 20 14 76
17B1:17 A9 00 8D E4 02 20 46 64
17B9:09 AD D9 02 C9 05 D0 03 3A
17C1:EE CB 02 A9 64 8D C8 02 22
17C9:20 42 10 4C A4 15 A9 0A 36
17D1:8D E5 17 CE E6 17 4C A7 E3
17D9:17 00 00 00 00 00 00 00 93
17E1:00 00 00 00 00 00 90 13 44
17E9:11 11 11 11 11 11 11 11 18
17F1:11 11 11 11 11 1D 1D 1D 74
17F9:1D 1D 1D 1D 1D 1D 1D 1D 28
1801:1D 47 41 4D 45 20 4F 56 2E
1809:45 52 00 61 FF 00 FF A9 30
1811:01 A0 FA 88 99 00 D8 99 E9
1819:FA D8 99 F4 D9 99 EE DA 6D
1821:D0 F1 60 00 00 00 00 00 42
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Power BASIC: Quick Save

Article on page 43.

Program 1: Quick Save—64 Version

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
GD 20 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE PUB.
      , INC."
QP 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED{DOWN}"
JQ 40 FORJ=828TO929:READA:POKE
      J,A:X=X+A:NEXTJ
SP 50 IFX<>11780THENPRINT"ERRO
      R IN DATA STATEMENTS.":S
      TOP
PP 60 PRINT"SYS 828 TOGGLES QU
      ICK SAVE ON AND OFF."
FK 70 DATA 169,79,32,210,255,1
      69,78,162,94,160
BX 80 DATA 3,204,1,3,208,9,169
      ,70,32,210
MG 90 DATA 255,162,139,160,227
      ,142,0,3,140,1
XB 100 DATA 3,76,210,255,173,0
      ,2,201,92,240
XH 110 DATA 3,76,139,227,206,0
      ,2,169,5,162
QJ 120 DATA 8,168,32,186,255,1
      69,6,162,156,160
GF 130 DATA 3,32,189,255,169,4
      3,166,45,164,46
FA 140 DATA 32,216,255,162,1,2
      54,160,3,189,160
FX 150 DATA 3,201,58,144,8,169
      ,48,157,160,3
KQ 160 DATA 202,16,238,76,116,
      164,70,73,76,69
PA 170 DATA 48,48
```

Program 2: Quick Save—128 Version

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
HG 20 BANK15:PRINT"{CLR}
      {3 SPACES}COPYRIGHT 1988
       COMPUTE PUB., INC."
QP 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED{DOWN}"
GK 40 FORJ=2816TO2930:READA:PO
      KEJ,A:X=X+A:NEXTJ
FM 50 IFX<>12263THENPRINT"ERRO
      R IN DATA STATEMENTS.":S
      TOP
XK 60 PRINT"SYS 2816 TOGGLES Q
      UICK SAVE ON AND OFF."
SQ 70 DATA 169,79,32,210,255,1
      69,78,162,34,160
QR 80 DATA 11,204,1,3,208,9,16
      9,70,32,210
XX 90 DATA 255,162,63,160,77,1
      42,0,3,140,1
XB 100 DATA 3,76,210,255,173,0
      ,2,201,92,240
EJ 110 DATA 3,76,63,77,206,0,2
      ,169,0,141
EE 120 DATA 0,255,169,5,162,8,
      168,32,186,255
GB 130 DATA 169,6,162,109,160,
      11,32,189,255,169
DA 140 DATA 0,170,32,104,255,1
      69,45,174,16,18
AH 150 DATA 172,17,18,32,216,2
      55,162,1,254,113
EK 160 DATA 11,189,113,11,201,
      58,144,8,169,48
RM 170 DATA 157,113,11,202,16,
      238,76,55,77,70
AJ 180 DATA 73,76,69,48,48
```

Program 3: Quick Save—Plus 4/16 Version

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
GD 20 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE PUB.
      , INC."
QP 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED{DOWN}"
JH 40 FORJ=818TO921:READA:POKE
      J,A:X=X+A:NEXTJ
GJ 50 IFX<>11820THENPRINT"ERRO
      R IN DATA STATEMENTS.":S
      TOP
RJ 60 PRINT"SYS 818 TOGGLES QU
      ICK SAVE ON AND OFF."
BP 70 DATA 169,79,32,210,255,1
      69,78,162,84,160
BX 80 DATA 3,204,1,3,208,9,169
      ,70,32,210
FX 90 DATA 255,162,134,160,134
      ,142,0,3,140,1
XB 100 DATA 3,76,210,255,173,0
      ,2,201,92,240
MX 110 DATA 3,76,134,134,206,0
      ,2,169,5,162
GS 120 DATA 8,168,32,186,255,1
      69,6,162,148,160
GF 130 DATA 3,32,189,255,169,4
      3,166,45,164,46
XF 140 DATA 32,216,255,162,1,2
      54,152,3,189,152
SB 150 DATA 3,201,58,144,8,169
      ,48,157,152,3
CC 160 DATA 202,16,238,162,128
      ,76,134,134,70,73
FS 170 DATA 76,69,48,48
```

SYS Stamper

Article on page 61.

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
SK 20 DIMBY$(255):T=18:S=1:DN$
      ="{15 DOWN}":Z$=CHR$(0)
JG 30 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC."
BR 40 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED":FORI=1T
      O1750:NEXT
RS 50 BL$="{40 SPACES}":BL$="
      {UP}"+BL$+BL$+"{2 UP}"
BM 60 OPEN15,8,15,"I0":GOSUB30
      0:OPEN5,8,5,"#"
KK 70 PRINT"{CLR}SYS STAMPER
      {2 SPACES}";:PRINT#15,"U
      A:"5;0;T;S:N=0
MP 80 PRINT#15,"B-P:"5;0:GET#5
      ,T$,S$:IFASC(T$+Z$)=0THE
      NPRINT"{RVS}LAST SECTOR"
      ;
AJ 90 PRINT:PRINT
PD 100 FORI=2TO226STEP32:PRINT
      #15,"B-P:"5;I
PA 110 FORJ=ITOI+18:GET#5,BY$(
      J):NEXT:GOSUB300
KJ 120 PRINT#15,"B-P:"5;I+28:G
      ET#5,BY$(I+28),BY$(I+29
      )
KC 130 BL=ASC(BY$(I+28)+Z$)+25
      6*ASC(BY$(I+29)+Z$)
QK 140 IF(ASC(BY$(I)+Z$)AND127
      )=0THEN170
AQ 150 N=N+1:BL(N)=BL:BY(N)=I:
      PRINT"{RVS}"N"{OFF}
      {LEFT}"BL(N),
HR 160 FORK=I+3TOI+18STEP4:PRI
      NTBY$(K)BY$(K+1)BY$(K+2
      )BY$(K+3);:NEXT:PRINT
RR 170 NEXT:N=N+1:PRINT:PRINT"
      {RVS}"N"{OFF} = NEXT SE
      CTOR":PRINT"{RVS}"0"
      {OFF} = QUIT{HOME}"DN$;
EA 180 X=0:PRINTBL$;:PRINT"ENT
      ER SELECTION."
XA 190 GETX$:X=VAL(X$):IFX$<"0
      "ORX$>"9"ORX>NTHEN190
MQ 200 IFX=NORX=0THENONX+1GOTO
      320:GOTO280
FQ 210 PRINT"{HOME}{DOWN}"LEFT
      $(DN$,X)X"{HOME}"DN$;
CG 220 NV=-1:PRINTBL$;:INPUT"E
      NTER STAMP";NV:NV=INT(N
      V)
```

```
HH 230 IFNV<0ORNV>65535THEN270
AG 240 HI=INT(NV/256):LO=NV-HI
       *256:BL(X)=NV
RK 250 PRINT#15,"B-P:"5;BY(X)+
       28:PRINT#5,CHR$(LO);CHR
       $(HI);
PP 260 PRINT#15,"U2:"5;0;T;S:G
       OSUB300
EK 270 PRINT"{HOME}{DOWN}"LEFT
       $(DN$,X)"{RVS}"X"{OFF}
       {LEFT}"LEFT$(STR$(BL(X)
       )+"{4 SPACES}",6)"
       {HOME}"DN$;:GOTO180
JG 280 T=ASC(T$+Z$):S=ASC(S$+Z
       $):IFT=0THENT=18:S=1
MJ 290 GOTO70
SD 300 INPUT#15,E,E$,ET,ES:IFE
       =0THENRETURN
HX 310 PRINT"{DOWN}ERROR #"E"
       {LEFT},"E$","ET"{LEFT},
       "ES
RR 320 CLOSE5:CLOSE15
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Musical Zippers

Article on page 65.

Zipper 1

```
HX 10 REM COPYRIGHT 1988 COMPU
      TE PUBLICATIONS, INC. -
      {SPACE}ALL RIGHTS RESERV
      ED
RH 20 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC."
AC 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED":FORI=1T
      01500:NEXT
EH 40 FORI=1TO64:READA:X=X+A:N
      EXT:IFX<>517636THENPRINT
      "{DOWN}DATA STATEMENT ER
      ROR":STOP
EX 50 RESTORE:PRINT"{CLR}
      {2 DOWN}":PRINTTAB(7)"MU
      SICAL ZIPPER IS CLOSED!"
      :PRINT
KC 60 F=.94:REM RELATIVE PITCH
       FACTOR. SEE LINE 130.
JQ 70 V=54272:V1=54273:V2=5427
      9:V3=54280:K=256:B=38:D=
      2
XP 80 FORT=VTOV+23:POKET,0:NEX
      T:REM CLEAR SOUND CHIP
GP 90 POKEV+24,15:REM VOLUME,
      {SPACE}BOTH VOICES
QP 100 POKEV+5,9:POKEV+6,16:PO
       KEV+12,9:POKEV+13,16:RE
       M ADSR'S
XQ 110 POKEV+3,8:POKEV+10,8:RE
       M SQUARE WAVE
JB 120 FORQ=1TO32:READM,N:REM
       {SPACE}VALUES FROM PROG
       RAMMER'S REFERENCE GUID
       E
QH 130 M=M*F:N=N/F:REM MULTIPL
       Y HIGHER VOICE, DIVIDE
       {SPACE}LOWER VOICE BY F
       ACTOR
RC 140 POKEV1,INT(M/K):POKEV,M
       -INT(M/K)*K:REM POKEABL
       E VALUES HIGH VOICE
QK 150 POKEV3,INT(N/K):POKEV2,
       N-INT(N/K)*K:REM POKEAB
       LE VALUES LOW VOICE
KG 160 POKEV+4,65:GOSUB240:POK
       EV+4,64:REM PLAY UPPER
       {SPACE}VOICE
KQ 170 POKEV+11,65:GOSUB250:PO
       KEV+11,64:REM PLAY LOWE
       R VOICE
PD 180 PRINTTAB((B-Z)/D)"{C}"S
       PC(Z)"{C}"
XG 190 NEXT:RESTORE:REM PRINT
       {SPACE}ZIPPER
GQ 200 F=F*1.2:Z=Z+2:REM INCRE
       ASE RELATIVE PITCH FACT
       OR AND SPACE INSIDE ZIP
       PER
KM 210 IFF>5THENF=5:Z=18:GOSUB
       230
KX 220 GOTO120
KC 230 PRINT:PRINTTAB(6)"MUSIC
       AL ZIPPER IS WIDE OPEN!
       ":PRINT:RETURN
PS 240 FORT=1TO90:NEXT:RETURN
AJ 250 FORT=1TO65:NEXT:RETURN
BP 260 DATA10814,8583,9634,858
       3,8583,9634,9634,10814,
       10814,8583,10814,10814,
       10814
SQ 270 DATA9634,0,6430,9634,85
       83,9634,8583,9634,9634,
       0,10814,10814,8583,1286
       0,0
AP 280 DATA12860,6430,0,0,1081
       4,8583,9634,8583,8583,9
       634,9634,10814,10814,11
       457
GX 290 DATA10814,10814,10814,9
       634,10814,8583,9634,810
       1,9634,6430,10814,7271,
       9634
SP 300 DATA8101,8583,8583,0,0,
       0,8583,0,0
```

Zipper 2

```
HX 10 REM COPYRIGHT 1988 COMPU
      TE PUBLICATIONS, INC. -
      {SPACE}ALL RIGHTS RESERV
      ED
RH 20 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC."
AC 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED":FORI=1T
      01500:NEXT
XA 40 FORI=1TO96:READA:X=X+A:N
      EXT:IFX<>787236THENPRINT
      "{DOWN}DATA STATEMENT ER
      ROR":STOP
AE 50 RESTORE:PRINT"{CLR}
      {7 DOWN}":PRINTTAB(8)"PR
      ESS AND HOLD SPACE BAR"
XF 60 PRINT:PRINTTAB(9)"TO OPE
      N MUSICAL ZIPPER"
QK 70 PRINT:PRINT:PRINTTAB(7)"
      HOLD U TO HEAR UPPER VOI
      CE
MX 80 PRINT:PRINTTAB(7)"HOLD L
       TO HEAR LOWER VOICE
SD 90 POKE650,128:REM REPEAT A
      LL KEYS. NECESSARY WHEN
      {SPACE}U AND L ARE HELD
      {SPACE}DOWN.
HH 100 F=.9
EE 110 V=54272:V1=54273:V2=542
       79:V3=54280:K=256
EK 120 FORT=VTOV+23:POKET,0:NE
       XT
JX 130 POKEV+24,15
CF 140 POKEV+5,9:POKEV+6,16:PO
       KEV+12,9:POKEV+13,16
SM 150 POKEV+3,8:POKEV+10,8
XB 160 FORQ=1TO48:READM,N:M=M*
       F:N=N/F
KP 170 IFA$="L"THENM=0:REM CAN
       CELS UPPER VOICE
CF 180 IFA$="U"THENN=0:REM CAN
       CELS LOWER VOICE
QK 190 POKEV1,INT(M/K):POKEV,M
       -INT(M/K)*K
MD 200 POKEV3,INT(N/K):POKEV2,
       N-INT(N/K)*K
DS 210 POKEV+4,65:GOSUB270:POK
       EV+4,64
HB 220 POKEV+11,65:GOSUB280:PO
       KEV+11,64
FQ 230 GETA$:IFA$=""THEN260
FR 240 IFA$=" "THENF=F*1.05:RE
       M SPACE BAR INCREASES R
       ELATIVE PITCH FACTOR
GX 250 IFF>4THENF=4:PRINT:PRIN
       T"{6 SPACES}MUSICAL ZIP
       PER IS WIDE OPEN!{2 UP}
       "
XK 260 NEXT:RESTORE:GOTO160
HX 270 FORT=1TO50:NEXT:RETURN
AJ 280 FORT=1TO35:NEXT:RETURN
PC 290 DATA6430,9634,7217,8583
       ,8101,8101,9634,6430,85
       83,6430,8583,4817,10814
       ,6430
FS 300 DATA9634,6430,9634,8101
       ,12860,6430,12139,8101,
       12860,9634,9634,8583,81
       01
DQ 310 DATA8101,6430,8583,7217
       ,7217,8101,7217,8583,54
       07,9634,7217,10814,7217
       ,9634
PK 320 DATA8583,8583,7217,8201
       ,8583,7217,10814,8101,9
       634,6430,8583,6069,8101
       ,6430
RD 330 DATA6430,7217,6430,4817
       ,4817,6069,6430,7217,64
       30,8583,8101,8101,6430,
       7217
EB 340 DATA8101,8101,9634,6430
       ,8583,7217,8101,8101,85
       83,9634,8101,8583,8583,
       8583
EF 350 DATA7217,10814,9634,963
       4,8583,9634,8101,12860,
       6430,12139,6430,12860,6
       430
```

Zipper 3

```
HX 10 REM COPYRIGHT 1988 COMPU
      TE PUBLICATIONS, INC. -
      {SPACE}ALL RIGHTS RESERV
      ED
RH 20 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC."
AC 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED":FORI=1T
      01500:NEXT
JM 40 FORI=1TO128:READA:X=X+A:
      NEXT:IFX<>1671982THENPRI
      NT"{DOWN}DATA ERROR":STO
      P
BG 50 RESTORE:PRINT"{CLR}
      {5 DOWN}":PRINTTAB(5)"PR
      ESS + TO OPEN ZIPPER ONE
       WAY
AD 60 PRINT:PRINTTAB(4)"PRESS
      {SPACE}- TO OPEN ZIPPER
      {SPACE}OTHER WAY
MC 70 PRINT:PRINT:PRINT:PRINTT
      AB(12)"(-.7625 TO 4.25)"
PD 80 PRINT:PRINT:PRINTTAB(9)"
      HOLD 1 TO HEAR VOICE 1
```

```
SF  90 PRINT:PRINTTAB(9)"HOLD 2
       TO HEAR VOICE 2
PD 100 POKE650,128
MQ 110 F=1.2:G=.6:REM F IS REL
       ATIVE PITCH FACTOR, G I
       S ABSOLUTE PITCH FACTOR
SE 120 GOSUB310
QH 130 V=54272:V1=54273:V2=542
       79:V3=54280:K=256
RH 140 FORT=VTOV+23:POKET,0:NE
       XT
XB 150 POKEV+24,15
MG 160 POKEV+5,9:POKEV+6,16:PO
       KEV+12,9:POKEV+13,16
FE 170 POKEV+3,8:POKEV+10,8
KR 180 FORQ=1TO64:READM,N:M=M*
       F*G:N=N/F*G
FP 190 IFA$="1"THENM=0
GJ 200 IFA$="2"THENN=0
DJ 210 POKEV1,INT(M/K):POKEV,M
       -INT(M/K)*K
CC 220 POKEV3,INT(N/K):POKEV2,
       N-INT(N/K)*K
PQ 230 POKEV+4,65:GOSUB330:POK
       EV+4,64
CQ 240 POKEV+11,65:GOSUB340:PO
       KEV+11,64
SG 250 GETA$:IFA$=""THEN300
DF 260 IFA$="+"THENF=F*1.05:GO
       SUB310
RC 270 IFA$="-"THENF=F*.95:GOS
       UB310
QA 280 IFF>5THENF=5
SP 290 IFF<.25THENF=.25
BF 300 NEXT:RESTORE:GOTO180
GB 310 POKE214,9:PRINT:POKE211
       ,9
AC 320 PRINT"DISTANCE APART =
       {SPACE}"F-1"{LEFT}
       {9 SPACES}":RETURN
AJ 330 FORT=1TO50:NEXT:RETURN
BH 340 FORT=1TO28:NEXT:RETURN
MG 350 DATA14435,0,12860,17167
       ,11457,17167,10814,1145
       7,11457,11457,12860,128
       60
SJ 360 DATA11457,11457,8583,10
       814,7217,10814,7647,192
       69,8583,19269,9634,1286
       0,8583
JP 370 DATA12860,7217,14435,85
       83,12860,0,11457,11457,
       11457,12860,22915,14435
       ,22915
KK 380 DATA13625,21629,14435,2
       1629,13625,20415,14435,
       20415,12860,19269,11457
       ,19269
JE 390 DATA12860,18188,14435,1
       8188,12860,17167,12860,
       17167,12139,19269,12860
       ,19269
CR 400 DATA0,17167,14435,17167
       ,12860,17167,11457,1716
       7,10814,11457,11457,114
       57
EJ 410 DATA12860,12860,11457,1
       1457,8583,10814,7217,10
       814,7647,19269,8583,192
       69
FJ 420 DATA9634,12860,8583,128
       60,7217,14435,8583,1286
       0,0,11457,11457,11457,1
       2860
ES 430 DATA14435,14435,15294,1
       7167,17167,0,19269,1926
       9,21629,17167,22915,144
       35
JX 440 DATA17167,11457,14435,1
       2860,15294,14435,16203,
       0,17167,12860,19269,0,2
       1629
RG 450 DATA11457,22915,0,0
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Scrambler

Article on page 47.

```
JM  10 S=54272
GD  20 OPEN 1,8,8,"SCRAMBLER HI
       GHS,S,W":CLOSE 1:OPEN 1,
       8,15:INPUT#1,A,B$
JH  30 IF B$<>"FILE EXISTS" THE
       N CLOSE 1:GOSUB 1880
EK  40 CLOSE 1
QA  50 DIM W$(200)
BA  60 DIM DC$(13),AL(26)
XS  70 FOR I=1 TO 13:READ DC$(I
       ):NEXT I
GQ  80 POKE 53280,0:POKE 53281,
       0:PRINT"{CLR}{DOWN}"
MA  90 GOSUB 1950
GM 100 PRINT"{YEL}UCCK
       {5 SPACES}{8}UCCI
       {5 SPACES}{PUR}UIUI
       {3 SPACES}";
PP 110 PRINT"{2 SPACES}{3}I
       {8 SPACES}{6}UCCI{YEL}J
       CCI{5 SPACES}{8}{Q}";
HR 120 PRINT"{c}{R}{k}
       {5 SPACES}{PUR}{b}{j}
       {k}{b}{5 SPACES}{3}{b}
       {7 SPACES}";
HM 130 PRINT" {6}{Q}C{R}K{YEL}
       UCCK{RED}UCCI {8}K JK
       {BLU}UCCI {PUR}K ";
DA 140 PRINT" {j} {GRN}{A}
       {2 c}{i}{3}{Z}{2 c}{i}
       {CYN}{u}{2 c}{k} {6}{k}
        {j}{k}{4 SPACES}{RED}
       {b}";
BB 150 PRINT"{8 SPACES}{BLU}
       {Q}{2 c}{W}{6 SPACES}
       {GRN}{Q}{2 c}{W}
       {3 SPACES}";
DQ 160 PRINT" {CYN}{Q}{c}
       {11 SPACES}{RED}{j}
       {2 c}{k}{5 SPACES}{BLU}
       {k} ";
AS 170 PRINT" J{6 SPACES}{GRN}
       {Z}CCK{4 SPACES}{CYN}JC
       CI{5 SPACES}";
JE 180 GOSUB 1950
FQ 190 PRINTSPC(4)"{DOWN}{5}UD
       I COPYRIGHT 1988"
CF 200 PRINTSPC(4)"GCH COMPUTE
       ! PUBLICATIONS INC."
FG 210 PRINTSPC(4)"JFK ALL RIG
       HTS RESERVED{2 DOWN}"
FK 220 PRINTSPC(3)"{WHT}NUMBER
        OF PLAYERS (1 - 4)
       {2 SPACES}1{3 LEFT}";:I
       NPUT NP
CK 230 IF NP<1 OR NP>4 THEN PR
       INT"{2 UP}":GOTO220
EP 240 FOR I=1 TO NP
HG 250 PRINTSPC(3)"{DOWN}PLAYE
       R";I;", YOUR NAME
       {16 SPACES}{16 LEFT}";
HD 260 INPUT P$(I)
QA 270 IF P$(I)="" THEN P$(I)=
       "PLAYER "+STR$(I)
KB 280 IF LEN(P$(I))>10 THEN P
       $(I)=LEFT$(P$(I),10)
FP 290 PRINT"{2 UP}";:NEXT I
KD 300 PRINTSPC(3)"{DOWN}GAME
       {SPACE}TYPE-WORDS, POIN
       TS (W,P)? ";
GM 310 GET A$
KE 320 IF A$<>"W" AND A$<>"P"
       {SPACE}THEN PRINT"
       {2 UP}":GOTO 300
SM 330 PRINT A$:GT$=A$
MJ 340 PRINTSPC(3)"{DOWN}TIMER
        LENGTH (1,3,5,7)
       {2 SPACES}3{3 LEFT}";:I
       NPUT TL$
XP 350 IF TL$<>"1" AND TL$<>"3
       " AND TL$<>"5" AND TL$<
       >"7" THEN PRINT"{2 UP}"
       ;:GOTO 340
HP 360 TL=VAL(TL$)
BG 370 SP$="{38 SPACES}"
XH 380 V0$=CHR$(0)
AK 390 FOR PL=1 TO NP
GS 400 TM=TL*600:NM=0:SC=0
KS 410 GOSUB 1350
AK 420 PRINT"{CLR}"
FB 430 POKE 53280,12:POKE 5328
       1,0:POKE 646,12
SM 440 FOR D=55296 TO 55303:PO
       KE D,11:POKE D+32,11
HB 450 POKE D-54272,160:POKE D
       -54240,160:NEXT
HF 460 FOR M=56256 TO 56295:PO
       KE M,11:NEXT:FOR M=5627
       4 TO 56276:POKE M,6:NEX
       T M
JG 470 FOR M=56285 TO 56294:PO
       KE M,6:NEXT M
QQ 480 FORD=55296 TO 56256 STE
       P 40:POKE D,11:POKE D+3
       9,11:POKE D-54272,160
EF 490 POKE D-54233,160:NEXT
FK 500 FOR D=1984 TO 2017:POKE
        D,160:NEXT
JP 510 FOR D=2019 TO 2022:POKE
        D,48:NEXT
XK 520 FOR M=0 TO 5:POKE 2013+
       M,ASC(MID$("SCORE"+CHR$
       (122),M+1,1))-64:NEXT M
DM 530 PRINT"{HOME}{BLU}":FOR
       {SPACE}X=1 TO 23:PRINT"
       {DOWN}";:NEXT
PD 540 PRINT"{RIGHT}{BLU}"P$(P
       L)"{HOME}";
GM 550 FOR X=1 TO 8:PRINT"
       {DOWN}";:NEXT
SF 560 FOR X=1 TO PL
JG 570 IF X>1 THEN PRINTSPC(9)
       P$(X-1);"'S SCORE WAS "
       ;SC(X-1);"{DOWN}":POKE
       {SPACE}198,0
PC 580 NEXT X
EB 590 PRINT"{DOWN}":PRINTSPC(
       5)"{RVS}{BLU}{4 SPACES}
       PRESS ANY KEY TO START
       {4 SPACES}"
MQ 600 GOSUB 1930
EB 610 GOSUB 1860
QR 620 PRINT"{HOME}{4}{RVS}
       {7 SPACES}{5} ";
GP 630 FOR I=1 TO 13:PRINT MID
       $(PS$,I,1);" ";:NEXT I
JP 640 FOR I=1 TO 26:POKE 4915
       2+I,0:NEXT I
AG 650 FOR I=1 TO 13
HE 660 N=ASC(MID$(PS$,I,1))-64
JQ 670 POKE 49152+N,PEEK(49152
       +N)+1
KS 680 NEXT I:PRINT:PRINT:PRIN
       T"{RIGHT}";
RQ 690 PRINT"{BLU}";
HR 700 NM=NM+1:WD$=""
XK 710 PRINT NM;
DS 720 FOR I=49153 TO 49178:PO
       KE 100+I,PEEK(I):NEXT I
FC 730 PRINT"{8}{P}{LEFT}{WHT}
       ";
```

```
AG 740 GET A$:TM=TM-.6:IF SS<>
       INT(TM/10) THEN SS=INT(
       TM/10):GOSUB 1690
MA 750 IF SS<=0 THEN GOSUB 157
       0:GOSUB 1630:GOTO 940
DH 760 IF INT(SS)=20 THEN POKE
        53280,2
MH 770 IF A$=CHR$(20) THEN IF
       {SPACE}WD$<>"" THEN PRI
       NT" {2 LEFT} {LEFT}{P}
       {LEFT}";:GOSUB 1660
DB 780 IF A$=CHR$(13) THEN 870
JD 790 IF A$<"A" OR A$>"Z" THE
       N 740
ER 800 TM=TM-2
FA 810 A=ASC(A$)+49188:IF PEEK
       (A)=0 THEN 740
HK 820 GOSUB 1510
PS 830 PRINT A$;
SX 840 WD$=WD$+A$
CJ 850 POKE A,PEEK(A)-1
PM 860 GOTO 730
HP 870 IF WD$="" THEN 790
MG 880 FL=1:IF NM=1 THEN 910
QB 890 FOR I=1 TO NM-1:IF WD$=
       W$(I) THEN FL=0
XS 900 NEXT I
QQ 910 IF FL=1 THEN W$(NM)=WD$
       :GOSUB 1570:GOSUB 1390:
       GOTO 690
JQ 920 FOR I=1 TO 2+LEN(WD$+ST
       R$(NM)):PRINT" {2 LEFT}
       ";:NEXT I:NM=NM-1
MK 930 GOSUB 1630:PRINT"
       {RIGHT}";:GOTO 690
AA 940 SC(PL)=SC:POKE 53280,12
       :PRINT:PRINT"{DOWN}
       {8 RIGHT}ANY DELETIONS?
       "
XF 950 GOSUB 1930
CB 960 IF A$="N" THEN 990
FD 970 IF A$<>"Y" THEN 950
XE 980 GOSUB 1730
DC 990 NEXT PL
BQ 1000 PRINT"{CLR}{2 DOWN}
       {BLU}":PRINT:IF NP=1 T
       HEN 1070
JF 1010 PRINT"THE SCORES:":PRI
       NT
HK 1020 HS=0:FOR I=1 TO NP:PRI
       NT P$(I),SC(I)
FP 1030 IF SC(I)>HS THEN WN=I:
       HS=SC(I)
QA 1040 NEXT I:PRINT
RR 1050 PRINT"{RED}THE WINNER
       {SPACE}IS ";P$(WN)
XE 1060 GOTO 1080
JJ 1070 PRINT"{CLR}{2 DOWN}
       {RED}YOUR SCORE IS ";S
       C(1):HS=SC(1):PRINT"
       {DOWN}{BLU}"
XE 1080 OPEN 1,8,2,"SCRAMBLER
       {SPACE}HIGHS,S,R":FOR
       {SPACE}I=1 TO 4:FOR J=
       1 TO 2:INPUT#1,HS(I,J)
CK 1090 NEXT J:NEXT I:CLOSE 1
DK 1100 I=INT(TL/2)+1:J=(0-(GT
       $="W"))+1
AB 1110 IF HS>HS(I,J) THEN HS(
       I,J)=HS:GOSUB 1880
EM 1120 PRINT"HIGH SCORES:"
MR 1130 PRINT:PRINT"","{BLU}PO
       INTS","WORDS":PRINT"
       {10 RIGHT}DDDDDD
       {4 RIGHT}DDDDD"
QB 1140 FOR I=1 TO 4:PRINT I*2
       -1,;:PRINT"{7 LEFT}MIN
       .{3 SPACES}";:FOR J=1
       {SPACE}TO 2
FD 1150 PRINT HS(I,J),:NEXTJ:P
       RINT:NEXT I
GF 1160 PRINT"{BLU}{2 DOWN}PLA
       Y AGAIN? {RED}S{BLU}AM
       E / {RED}N{BLU}EW /
       {RED}Q{BLU}UIT"
RC 1170 GOSUB 1930
EH 1180 IF A$="S" THEN 390
SQ 1190 IF A$="N" THEN GOTO 80
KC 1200 IF A$="Q" THEN PRINT"
       {CLR}":END
FX 1210 GOTO 1170
MH 1220 DATA BOWYOL
BD 1230 DATA TIKRBH
QC 1240 DATA AEAEAE
RX 1250 DATA FPLHBN
JH 1260 DATA FINUTP
FH 1270 DATA OCOMPW
CC 1280 DATA VQYSWS
AG 1290 DATA PQVWAI
AC 1300 DATA SIHRUF
JP 1310 DATA KDGJMC
QG 1320 DATA EAEAEA
GD 1330 DATA ZQXEVJ
KH 1340 DATA SUMRGI
JD 1350 PS$=""
GJ 1360 FOR I=1 TO 13:PS$=PS$+
       MID$(DC$(I),INT(RND(0)
       *6+1),1)
BA 1370 NEXT I
JG 1380 RETURN
DB 1390 PRINT" ";:POKE 783,1:S
       YS 65520
HJ 1400 IF PEEK(782)>28 THEN P
       RINT:PRINT"{RIGHT}";:P
       OKE 783,1:SYS 65520
HQ 1410 IF PEEK(781)>22 THEN G
       OSUB 1860:PRINT"{HOME}
       {2 DOWN}{RIGHT}";
EB 1420 NL=LEN(WD$):IF NL>5 TH
       EN NL=6
MK 1430 NL=NL-(NL>3)-(NL>4)-(N
       L>5)
CJ 1440 IF GT$="P" THEN SC=SC+
       NL
EE 1450 IF GT$="W" THEN SC=SC+
       1
MB 1460 SC$=STR$(SC)
MB 1470 SC$=RIGHT$(SC$,LEN(SC$
       )-1)
QH 1480 IF LEN(SC$)<4 THEN SC$
       ="0"+SC$:GOTO 1480
MQ 1490 FOR I=1 TO LEN(SC$):PO
       KE 2018+I,ASC(MID$(SC$
       ,I,1)):NEXT I
EX 1500 RETURN
PE 1510 POKE S+24,11
DH 1520 POKE S+3,8:POKE S+5,0:
       POKE S+6,240
SF 1530 POKE S,47:POKE S+1,65
RD 1540 POKE S+4,65
GM 1550 POKE S+4,64:POKE S+24,
       0
KD 1560 RETURN
KK 1570 POKE S+24,11
KJ 1580 POKE S+1,130
EJ 1590 POKE S+5,9:POKE S+15,3
       0
EX 1600 POKE S+4,21
GP 1610 FOR T=1TO 75:NEXT:POKE
        S+4,20
GJ 1620 POKE 54273,0:POKE 5427
       2,0:RETURN
BX 1630 POKE S+24,10:POKE S+5,
       128:POKE S+6,248
EF 1640 POKE S+1,5:POKE S+4,33
       :FOR B3=1 TO 119:NEXT:
       POKE S+1,0:POKE S+24,0
RR 1650 POKE 54273,0:POKE 5427
       2,0:RETURN
PD 1660 A=ASC(RIGHT$(WD$,1))-6
       4:POKE 49252+A,PEEK(49
       252+A)+1
MD 1670 WD$=LEFT$(WD$,LEN(WD$)
       -1)
KP 1680 RETURN
MF 1690 SS$=STR$(SS):SS$=RIGHT
       $(SS$,LEN(SS$)-1)
HQ 1700 IF LEN(SS$)<3 THEN SS$
       =" "+SS$:GOTO 1700
MG 1710 FOR I=1 TO 3:POKE 2001
       +I,ASC(MID$(SS$,I,1)):
       NEXT I
BR 1720 RETURN
QK 1730 GOSUB 1860
GC 1740 SC=SC(PL)
ME 1750 FOR I=1 TO NM-1:PRINT"
       {HOME}{5 DOWN}
       {2 RIGHT}";W$(I);"
       {9 SPACES}"
RB 1760 PRINT"{2 RIGHT}IS THIS
        WORD CORRECT? (Y/N)"
HJ 1770 GOSUB 1930
QG 1780 IF A$="N" THEN WD$=W$(
       I):GOSUB 1810
XD 1790 NEXT I:SC(PL)=SC
EA 1800 RETURN
GH 1810 NL=LEN(WD$):IF NL>5 TH
       EN NL=6
RS 1820 NL=NL-(NL>3)-(NL>4)-(N
       L>5)
RQ 1830 IF GT$="P" THEN SC=SC-
       NL
QK 1840 IF GT$="W" THEN SC=SC-
       1
DE 1850 RETURN
RS 1860 PRINT"{HOME}{DOWN}":FO
       RI=1TO22:PRINT"{RIGHT}
       {38 SPACES}":NEXTI
KH 1870 RETURN
XC 1880 OPEN1,8,15,"S0:SCRAMBL
       ER HIGHS":CLOSE 1
QB 1890 PRINT"{DOWN}{WHT}WRITI
       NG NEW HI SCORE{DOWN}
       {BLU}"
XJ 1900 OPEN 1,8,8,"SCRAMBLER
       {SPACE}HIGHS,S,W":FOR
       {SPACE}I=1 TO 4:FOR J=
       1 TO 2:PRINT#1,HS(I,J)
KE 1910 NEXT J:NEXT I
HB 1920 CLOSE 1:OPEN 1,8,15:IN
       PUT#1,A,B$:CLOSE 1:RET
       URN
SJ 1930 GET A$:IF A$="" THEN 1
       930
MP 1940 RETURN
XR 1950 FOR D=1 TO 40:PRINT"
       {WHT}C";:NEXT
AR 1960 RETURN
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

V-8

Article on page 53.

Program 1: V-8 Loader

```
PK 10 S=49664:V=49152:PG=0:REM
       PG=0 IF SCREEN OR 16K B
      ANK WILL CHANGE
PJ 15 POKE646,14:POKE53280,14:
      POKE53281,6
AG 20 PRINT"{CLR}{RVS} V-8 LOA
      DER{2 SPACES}-{2 SPACES}
      COPYRIGHT 1988 COMPUTE!
      {SPACE}"
DA 30 PRINT"{DOWN}"SPC(10)"CRE
      ATING PROGRAM...."
BJ 40 FORX=STOS+208:READD:POKE
```

```
      X,D:CK=CK+D:NEXT
JD 50 IFCK<>26449THENPRINT"
      {DOWN}{5 SPACES}ERROR IN
       DATA! LINES 690-1040":E
      ND
EC 60 FORX=S+209TOS+264:READD:
      POKEX,D:NEXT
FG 70 CK=0:FORX=S+265TOS+277:R
      EADD:POKEX,D:CK=CK+D:NEX
      T
HS 80 IFCK<>1848THENPRINT"
      {DOWN}{5 SPACES}ERROR IN
       DATA! LINES 1150-1170":
      END
DS 90 S2=S+278:T=S2:FORX=0TO46
      :READD:IFD<>1THEN120
KC 100 N=V+X*8:GOSUB680
AP 110 POKET,185:POKET+1,L:POK
      ET+2,H:POKET+3,141:POKE
      T+4,X:POKET+5,208:T=T+6
CJ 120 NEXT
FD 130 S3=T:READD:IFD<>1THEN16
      0
RM 140 N=V+376:GOSUB680
CR 150 POKET,185:POKET+1,L:POK
      ET+2,H:POKET+3,141:POKE
      T+4,0:POKET+5,221:T=T+6
JP 160 S4=T:FORX=0TO7:READD:IF
      D<>1THEN200
KS 170 N=V+(48+X)*8:GOSUB680
HC 180 POKET,185:POKET+1,L:POK
      ET+2,H:POKET+3,141:POKE
      T+4,X+248:POKET+5,PG:T=
      T+6
XB 190 SP(X)=1:SN=SN+1
XR 200 NEXT
FP 210 CK=0:S5=T:FORX=S5TOS5+8
      :READD:POKEX,D:CK=CK+D:
      NEXT
KF 220 IFCK<>1401THENPRINT"
      {DOWN}{5 SPACES}ERROR I
      N DATA! LINES 1280-1300
      ":END
BM 230 T=0:S6=S5+9:IF(PG>0ANDP
      G<256)ORSN=0THENFORX=0T
      O23:READD:NEXT:S7=S6:GO
      TO310
KM 240 CK=0:FORX=S6TOS6+23:REA
      DD:POKEX,D:CK=CK+D:NEXT
QS 250 IFCK<>2288THENPRINT"
      {DOWN}{5 SPACES}ERROR I
      N DATA! LINES 1310-1350
      ":END
CX 260 FORX=0TO7:IFSP(X)<>1THE
      N300
AM 270 N=S4+5+T*2:GOSUB680
KF 280 POKES6+T+24,141:POKES6+
      T+25,L:POKES6+T+26,H
XR 290 POKES+T+32,141:POKES+T+
      33,L:POKES+T+34,H:T=T+3
XS 300 NEXT:S7=S6+24+SN*3
EP 310 IFT<24THENFORX=S+T+32TO
      S+55:POKEX,234:NEXT
FH 320 CK=0:FORX=S7TOS7+9:READ
      D:POKEX,D:CK=CK+D:NEXT
BB 330 IFCK<>1505THENPRINT"
      {DOWN}{5 SPACES}ERROR I
      N DATA! LINES 1360-1380
      ":END
HG 340 E=S7+9:LE=E-S+1:O=S+82:
      I=S+161:NM=S+1:DF=S+209
RD 350 N=V+192:GOSUB680:POKES+
      9,L:POKES+10,H
DF 360 IFS7<>S6THENPOKES6+1,L:
      POKES6+2,H
ES 370 N=V+376:GOSUB680:POKES+
      20,L:POKES+21,H
DQ 380 IFS7<>S6THENPOKES6+12,L
      :POKES6+13,H
BB 390 N=S+209:GOSUB680:POKES+
      105,L:POKES+106,H
PQ 400 POKES+116,L:POKES+117,H
XA 410 POKES+150,L:POKES+151,H
ER 420 POKES+176,L:POKES+177,H
FH 430 N=S+179:GOSUB680:POKES+
      164,L:POKES+165,H
GP 440 POKES+187,L:POKES+188,H
JC 450 POKES+193,L:POKES+194,H
CP 460 N=S+180:GOSUB680:POKES+
      169,L:POKES+170,H
FF 470 POKES+196,L:POKES+197,H
RB 480 POKES+201,L:POKES+202,H
XE 490 N=S+265:GOSUB680:POKES+
      67,L:POKES+72,H
MA 500 N=S+154:GOSUB680:POKES+
      147,L:POKES+148,H
DR 510 N=V:GOSUB680:POKES+162,
      L:POKES+167,H
DB 520 N=V+144:GOSUB680:POKES+
      273,L:POKES+274,H
GK 530 PRINT"{DOWN}{2 SPACES}S
      TART="S"END="E"LENGTH="
      LE
EJ 540 INPUT"{2 DOWN}
      {11 SPACES}SAVE IT TO D
      ISK";I$
CC 550 IF I$<>"Y"THEN610
FD 560 INPUT"{DOWN}{8 SPACES}F
      ILENAME";F$:IFF$=""THEN
      610
CX 570 F$="0:"+F$:OPEN1,8,1,F$
CE 580 N=S:GOSUB680:POKE253,L:
      POKE254,H
AJ 590 N=E+1:GOSUB680:POKE781,
      L:POKE782,H
KC 600 POKE780,253:SYS65496:CL
      OSE1
BH 610 PRINT"{2 DOWN}
      {2 SPACES}{RVS}POKE"NM"
      {OFF}# OF SPLITS IN SCR
      EEN"
PP 620 PRINT"{2 SPACES}{RVS}SY
      S"I"{OFF}TO INIT. SHADO
      W REGISTERS"
SF 630 PRINT"{2 SPACES}{RVS}SY
      S"S"{OFF}TO ACTIVATE"
JG 640 PRINT"{2 SPACES}{RVS}SY
      S"O"{OFF}TO DE-ACTIVATE
      "
PM 650 PRINT"{2 SPACES}{RVS}"V
      "{LEFT}";-V-447"{OFF}=
      {SPACE}SHADOW REGISTERS
      "
QQ 660 PRINT"{2 SPACES}{RVS}"D
      F"{LEFT}";-DF-55"{OFF}=
       DEFAULTS TABLE"
QA 670 END
XQ 680 H=INT(N/256):L=N-H*256:
      RETURN
DQ 690 REM --- SECTION 1 DATA
      {SPACE}---
FR 700 DATA169,8,133,251,169,0
JF 710 DATA133,252,173,192,192
      ,41
DK 720 DATA240,74,74,9,3,133
FX 730 DATA253,173,120,193,73,
      3
JH 740 DATA10,10,10,10,10,10
SF 750 DATA5,253,141,17,196,14
      1
EF 760 DATA23,196,141,29,196,1
      41
XX 770 DATA35,196,141,41,196,1
      41
KF 780 DATA47,196,141,53,196,1
      41
CP 790 DATA59,196,169,27,141,1
      7
DD 800 DATA208,169,127,141,13,
      220
BF 810 DATA169,9,141,20,3,169
MF 820 DATA195,141,21,3,169,24
      1
RC 830 DATA141,26,208,96,169,2
      40
AD 840 DATA141,26,208,169,49,1
      41
FC 850 DATA20,3,169,234,141,21
SX 860 DATA3,169,129,141,13,22
      0
SA 870 DATA160,0,185,209,194,1
      53
MQ 880 DATA0,208,200,192,47,20
      8
SK 890 DATA245,185,209,194,141
      ,0
PH 900 DATA221,200,173,24,208,
      41
EF 910 DATA240,74,74,9,3,133
SR 920 DATA253,173,0,221,73,3
XD 930 DATA10,10,10,10,10,10
GM 940 DATA5,253,141,154,194,1
      85
JH 950 DATA209,194,153,200,7,2
      00
CE 960 DATA192,56,208,245,96,1
      69
BS 970 DATA0,141,179,194,169,1
      92
RX 980 DATA141,180,194,160,0,1
      62
JP 990 DATA0,185,209,194,157,0
MP 1000 DATA192,232,224,8,208,
      248
JG 1010 DATA173,179,194,24,105
      ,8
BB 1020 DATA141,179,194,173,18
      0,194
DA 1030 DATA105,0,141,180,194,
      200
SK 1040 DATA192,56,208,221,96
FQ 1050 REM ***** DEFAULTS ***
      **
RP 1060 DATA0,0,0,0,0,0,0,0
DC 1070 DATA0,0,0,0,0,0,0,0,0
BA 1080 DATA27,0,0,0,0
CR 1090 DATA200,0,21,120,240
XF 1100 DATA0,0,0,0,0
SS 1110 DATA14,6,0,1,2,3,4
MG 1120 DATA5,6,7,8,9,10,11,12
KX 1130 DATA199
KS 1140 DATA0,0,0,0,0,0,0,0
SB 1150 REM --- SECTION 1 CONT
      'D ---
XA 1160 DATA169,1,141,25,208,1
      64
XD 1170 DATA252,185,144,192,14
      1,18,208
FJ 1180 REM ***** VM REGISTERS
       *****
FH 1190 DATA1,1,1,1,1,1,1,1,1:RE
      M SPRITE 0-3 X,Y COORD
      INATES
DS 1200 DATA1,1,1,1,1,1,1,1,1,1:
      REM SPRITE 4-7 X,Y COO
      RDINATES;SPRITE 0-7 X
      {SPACE}MSB
PQ 1210 DATA1,-1,-1,-1,1:REM C
      TRL(53265);RASTER;LPX;
      LPY;SPRITE ENABLE
JA 1220 DATA1,1,1,-1,-1:REM CT
      RL(53270);SPR Y EXPAND
      ;MEM CTRL;IRQ FLAG;IRQ
       ENABLE
CM 1230 DATA1,1,1,-1,-1:REM SP
      R PRIORITY;SPR MCM;SPR
       X EXPAND;SPR-SPR;SPR-
      BKG
FB 1240 DATA1,1,1,1,1,1,1,1:REM
      {SPACE}BORDER;BKG 0-3;
      SPRITE MC 0-1
AR 1250 DATA1,1,1,1,1,1,1,1,1:RE
      M SPRITE 0-7 COLOR
DJ 1260 DATA1:REM 16K VIC BANK
       (56576)
XB 1270 DATA1,1,1,1,1,1,1,1,1:RE
      M SPRITE 0-7 POINTERS
KG 1280 REM --- SECTION 5 DATA
       ---
```

```
HJ 1290 DATA200,196,251,208,2,
        160
GP 1300 DATA0,132,252
QA 1310 REM --- SECTION 6 DATA
        ---
JJ 1320 DATA185,192,192,41,240
        ,74
QJ 1330 DATA74,9,3,133,253,185
DM 1340 DATA120,193,73,3,10,10
SK 1350 DATA10,10,10,10,5,253
KX 1360 REM --- SECTION 7 DATA
        ---
GX 1370 DATA165,252,208,3,76,4
        9
QK 1380 DATA234,76,188,254
```

Program 2: Fade In/Out

```
HQ 10 REM FADE IN/OUT - COPYRI
      GHT 1988 COMPUTE! PUBLIC
      ATIONS, INC.
QG 20 REM REGISTERS: 32,33
PB 30 V=49152:S=49664:I=S+161:
      O=S+82:DF=S+209
CF 40 POKES+1,3:SYSI
KB 50 POKEV+32*8+0,0:POKEV+33*
      8+0,0
RK 60 POKEV+32*8+1,7:POKEV+33*
      8+1,7
FP 70 POKEV+32*8+2,0:POKEV+33*
      8+2,0
CG 80 POKEV+18*8,149:POKEV+18*
      8+1,150:POKEV+18*8+2,1
HS 90 SYSS
HG 100 PRINT"{CLR}{BLK}";:FORX
       =1TO12:PRINTSPC(15)"
       {DOWN}FADING IN":NEXT
MR 110 FORX=0TO105:POKEV+18*8,
       149-X:POKEV+18*8+1,150+
       X:NEXT
GH 120 PRINT"{CLR}{YEL}";:FORX
       =1TO12:PRINTSPC(15)"
       {DOWN}FADING OUT":NEXT
BS 130 FORX=0TO105:POKEV+18*8,
       44+X:POKEV+18*8+1,255-X
       :NEXT
JK 140 GOTO100
```

Program 3: Mixed Modes

```
XP 10 REM MIXED MODES - COPYRI
      GHT 1988 COMPUTE! PUBLIC
      ATIONS, INC.
KK 20 REM REGISTERS 17,24,32,3
      3
BJ 30 V=49152:S=49664:O=S+82:I
      =S+161:DF=S+209
HP 40 FORX=820TO850:READD:POKE
      X,D:NEXT
BM 50 PRINT"{CLR}":POKES+1,2:S
      YSI
GP 60 POKEV+18*8,114:POKEV+18*
      8+1,186
JJ 70 POKEV+32*8,1:POKEV+33*8,
      0:POKEV+32*8+1,1:POKEV+3
      3*8+1,0
SX 80 POKEV+17*8,59:POKEV+17*8
      +1,27
JB 90 POKEV+24*8,29:POKEV+24*8
      +1,21
RR 100 B=8192:E=16192:N=0:GOSU
       B280
AB 110 B=1024:E=1304:N=48:GOSU
       B280
RB 120 B=1304:E=1744:N=32:GOSU
       B280
XR 130 B=1744:E=2024:N=112:GOS
       UB280
RX 140 SYSS
RG 150 PRINT"{HOME}{9 DOWN}
       {RVS}{CYN}{18 SPACES}SI
       NE{18 SPACES}"
KA 160 PRINTSPC(12)"{7}HIGH-RE
       S AND TEXT"
BC 170 PRINTSPC(7)"(OR OTHER G
       RAPHICS MODES)"
QQ 180 PRINT"{4 SPACES}CAN BE
       {SPACE}MIXED ON THE SAM
       E SCREEN."
DS 190 PRINT"{2 DOWN}{RVS}
       {YEL}{17 SPACES}COSINE
       {17 SPACES}"
BP 200 FORX=100TO219
HR 210 Y1=INT(35+10*SIN(X/10))
       :Y2=INT(170+10*COS(X/10
       ))
KE 220 B1=8192+INT(Y1/8)*320+I
       NT(X/8)*8+(Y1AND7)
SD 230 B2=8192+INT(Y2/8)*320+I
       NT(X/8)*8+(Y2AND7)
DB 240 BI=7-(XAND7)
QB 250 POKEB1,PEEK(B1)OR(2↑BI)
       :POKEB2,PEEK(B2)OR(2↑BI
       )
ER 260 NEXTX
PG 270 GOTO270
XF 280 BH=INT(B/256):BL=B-BH*2
       56:POKE823,BL:POKE824,B
       H
BB 290 EH=INT(E/256):EL=E-EH*2
       56:POKE840,EL:POKE847,E
       H
KG 300 POKE821,N:SYS820:RETURN
HK 310 DATA169,0,141,255,255,2
       38,55,3
XE 320 DATA173,55,3,208,3,238,
       56,3
GM 330 DATA173,55,3,201,0,208,
       233,173
KJ 340 DATA56,3,201,0,208,226,
       96
```

Program 4: Window Scroll

```
BH 10 REM WINDOW SCROLL - COPY
      RIGHT 1988 COMPUTE! PUBL
      ICATIONS, INC.
HJ 20 REM REGISTERS: 22,32,33
BJ 30 V=49152:S=49664:O=S+82:I
      =S+161:DF=S+209
BC 40 FORX=828TO852:READD:POKE
      X,D:NEXT
CF 50 POKES+1,2:SYSI
XC 60 POKEV+18*8,238:POKEV+18*
      8+1,1
JX 70 POKEV+22*8,200:POKEV+22*
      8+1,192
GD 80 POKEV+32*8,1:POKEV+32*8+
      1,1
MS 90 POKEV+33*8,1:POKEV+33*8+
      1,13
RQ 100 SYSS
XH 110 PRINT"{CLR}{BLK}
       {8 DOWN}{3 SPACES}NOTIC
       E HOW ONLY THE BOTTOM L
       INE OF"
XB 120 PRINT"{DOWN}{3 SPACES}T
       EXT SCROLLS.{2 SPACES}T
       HE UPPER PORTION"
XJ 130 PRINT"{DOWN}{3 SPACES}O
       F THE SCREEN REMAINS ST
       ATIONARY!"
SS 140 PRINT"{11 DOWN}{GRN}THI
       S IS A SMOOTH SCROLLING
        TEXT WINDOW.";
HF 150 FORX=6TO0STEP-1:POKEV+1
       77,(PEEK(V+177)AND248)+
       X:NEXT
RQ 160 SYS828:POKEV+177,199:GO
       TO150
EG 170 DATA173,18,208,208,251,
       173,192,7
DR 180 DATA141,232,7,160,0,185
       ,193,7,153
FA 190 DATA192,7,200,192,40,20
       8,245,96
```

Program 5: Color Creator

```
KM 10 REM COLOR CREATOR - COPY
      RIGHT 1988 COMPUTE! PUBL
      ICATIONS, INC.
QG 20 REM REGISTERS: 32,33
BJ 30 V=49152:S=49664:O=S+82:I
      =S+161:DF=S+209
DP 40 POKES+1,6:SYSI
SG 50 PRINT"{CLR}{2 DOWN}"SPC(
      16)"COLOR 1"
KP 60 PRINT"{6 DOWN}"SPC(16)"C
      OLOR 2"
KA 70 PRINT"{8 DOWN}"SPC(14)"C
      OLORS 1 & 2"
XH 80 POKEV+18*8+0,100:POKEV+1
      8*8+1,150:POKEV+18*8+2,1
AK 90 POKEV+18*8+3,100:POKEV+1
      8*8+4,150:POKEV+18*8+5,1
RQ 100 SYSS
MS 110 C=0
AD 120 C1=INT(C/16):C2=C-16*C1
JK 130 POKEV+32*8+0,C1:POKEV+3
       3*8+0,C1:POKEV+32*8+3,C
       1:POKEV+33*8+3,C1
CS 140 POKEV+32*8+2,C1:POKEV+3
       3*8+2,C1
DD 150 POKEV+32*8+1,C2:POKEV+3
       3*8+1,C2:POKEV+32*8+4,C
       2:POKEV+33*8+4,C2
KP 160 POKEV+32*8+5,C2:POKEV+3
       3*8+5,C2
MH 170 GETK$
GF 180 IFK$="{LEFT}"THENC=C-1:
       IFC<0THENC=0
AA 190 IFK$="{RIGHT}"THENC=C+1
       :IFC>255THENC=255
BR 200 GOTO120
```

Program 6: 64 Sprites

```
XK 10 REM 64 SPRITES - COPYRIG
      HT 1988 COMPUTE! PUBLICA
      TIONS, INC.
QF 20 REM REGISTERS: ALL
BJ 30 V=49152:S=49664:O=S+82:I
      =S+161:DF=S+209
EP 40 PRINT"{CLR}";:POKES+1,8:
      SYSI
BM 50 FORX=VTOV+447:READD:POKE
      X,D:NEXT
GQ 60 SYSS
GK 70 FORX=12288TO16383:POKEX,
      255:NEXT
DJ 1000 DATA32,32,32,32,32,32,
        32,32:REM 0X
EQ 1001 DATA52,77,102,127,152,
        177,202,227:REM 0Y
DC 1002 DATA72,72,72,72,72,72,
        72,72:REM 1X
JK 1003 DATA52,77,102,127,152,
        177,202,227:REM 1Y
KM 1004 DATA112,112,112,112,11
        2,112,112,112:REM 2X
QM 1005 DATA52,77,102,127,152,
        177,202,227:REM 2Y
SE 1006 DATA152,152,152,152,15
        2,152,152,152:REM 3X
AG 1007 DATA52,77,102,127,152,
        177,202,227:REM 3Y
HA 1008 DATA192,192,192,192,19
        2,192,192,192:REM 4X
ED 1009 DATA52,77,102,127,152,
        177,202,227:REM 4Y
KQ 1010 DATA232,232,232,232,23
        2,232,232,232:REM 5X
FC 1011 DATA52,77,102,127,152,
        177,202,227:REM 5Y
MX 1012 DATA16,16,16,16,16,16,
        16,16:REM 6X
MX 1013 DATA52,77,102,127,152,
        177,202,227:REM 6Y
BM 1014 DATA56,56,56,56,56,56,
```

```
        56,56:REM 7X
SJ 1015 DATA52,77,102,127,152,
        177,202,227:REM 7Y
KR 1016 DATA192,192,192,192,19
        2,192,192,192:REM MSB
QK 1017 DATA27,27,27,27,27,27,
        27,27:REM 53265
FP 1018 DATA70,95,120,145,170,
        195,220,1:REM RASTER
EQ 1019 DATA0,0,0,0,0,0,0,0:RE
        M LPX
CQ 1020 DATA0,0,0,0,0,0,0,0:RE
        M LPY
DR 1021 DATA255,255,255,255,25
        5,255,255,255:REM SPRI
        TE ENABLE
CX 1022 DATA200,200,200,200,20
        0,200,200,200:REM 5327
        0
DC 1023 DATA0,0,0,0,0,0,0,0:RE
        M Y EXPAND
MF 1024 DATA21,21,21,21,21,21,
        21,21:REM MEM CONTROL
QP 1025 DATA0,0,0,0,120,120,12
        0,120:REM INTERRUPT FL
        AG
MP 1026 DATA0,0,0,0,240,240,24
        0,240:REM INTERRUPT EN
        ABLE
FX 1027 DATA255,255,255,255,25
        5,255,255,255:REM SPRI
        TE PRIORITY
ED 1028 DATA0,0,0,0,0,0,0,0:RE
        M SPRITE MULTICOLOR MO
        DE
SK 1029 DATA0,0,0,0,0,0,0,0:RE
        M SPRITE X EXPAND
RH 1030 DATA0,0,0,0,0,0,0,0:RE
        M SPRITE-SPRITE COLLIS
        ION
KB 1031 DATA0,0,0,0,0,0,0,0:RE
        M SPRITE-DATA COLLISIO
        N
MG 1032 DATA1,1,1,1,1,1,1,1:RE
        M BORDER COLOR
GE 1033 DATA0,0,0,0,0,0,0,0:RE
        M BACKGROUND 0
RE 1034 DATA2,2,2,2,240,240,24
        0,240:REM BACKGROUND 1
KB 1035 DATA3,3,3,3,241,241,24
        1,241:REM BACKGROUND 2
AR 1036 DATA4,4,4,4,242,242,24
        2,242:REM BACKGROUND 3
FF 1037 DATA2,5,7,5,243,243,24
        3,243:REM SPRITE MCM 0
KE 1038 DATA3,6,5,6,244,244,24
        4,244:REM SPRITE MCM 1
FE 1039 DATA11,12,15,1,5,13,7,
        9:REM 0COLOR
HH 1040 DATA12,15,1,5,13,7,9,2
        :REM 1COLOR
SD 1041 DATA15,1,5,13,7,9,2,8:
        REM 2COLOR
MQ 1042 DATA1,5,13,7,9,2,8,10:
        REM 3COLOR
ES 1043 DATA5,13,7,9,2,8,10,4:
        REM 4COLOR
GC 1044 DATA13,7,9,2,8,10,4,6:
        REM 5COLOR
HE 1045 DATA7,9,2,8,10,4,6,14:
        REM 6COLOR
EC 1046 DATA9,2,8,10,4,6,14,3:
        REM 7COLOR
MM 1047 DATA199,199,199,199,19
        9,199,199,199:REM BANK
PK 1048 DATA 192,200,208,216,2
        24,232,240,248:REM 0DE
        FINITION
FK 1049 DATA 193,201,209,217,2
        25,233,241,249:REM 1DE
        FINITION
MR 1050 DATA 194,202,210,218,2
        26,234,242,250:REM 2DE
        FINITION
GR 1051 DATA 195,203,211,219,2
        27,235,243,251:REM 3DE
        FINITION
XP 1052 DATA 196,204,212,220,2
        28,236,244,252:REM 4DE
        FINITION
BP 1053 DATA 197,205,213,221,2
        29,237,245,253:REM 5DE
        FINITION
QP 1054 DATA 198,206,214,222,2
        30,238,246,254:REM 6DE
        FINITION
EP 1055 DATA 199,207,215,223,2
        31,239,247,255:REM 7DE
        FINITION
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

The *GEOS Column:* Super Printer Driver

Article on page 42.

Program 1: Driver

```
XF 100 REM PR.OBJ PATCH PROGRA
       M
QJ 110 IF A=0 THEN POKE55,0:PO
       KE56,120:CLR:A=1:REM SE
       T TOP OF BASIC TO $7800
XG 120 IF A=1 THEN A=2:LOAD"0:
       PR.OBJ",8,1
RR 121 POKE31548,45:POKE31549,
       127:POKE31638,45:POKE31
       639,127
GD 122 POKE31650,54:POKE31651,
       127:POKE30793,63
EQ 123 FOR I=0 TO 17:READ A:PO
       KE(32557+I),A:NEXT
GC 124 DATA 32,95,194,32,93,19
       3,76,92,194
RM 125 DATA 32,95,194,32,99,19
       3,76,92,194
RA 130 PRINT"{CLR}COPYRIGHT 19
       88 COMPUTE! PUBL., INC.
       "
AB 140 PRINT"{6 SPACES}ALL RIG
       HTS RESERVED"
CR 150 PRINT"{DOWN}PR.OBJ PATC
       H PROGRAM/GEOS CONVERTE
       R"
HQ 160 PRINT"{2 DOWN}SELECT BA
       SIC PRINTER TYPE:"
GB 170 PRINT"{2 SPACES}1. EPSO
       N FX85/86E"
SP 180 PRINT"{2 SPACES}2. EPSO
       N LX80/86"
GA 190 PRINT"{2 SPACES}3. STAR
       {2 SPACES}SG10/15"
XR 200 PRINT"{2 SPACES}4. CUST
       OM"
DF 210 INPUT"{DOWN}SELECTION";
       PTYPE
JS 220 :
SG 230 ON PTYPE GOTO250,280,34
       0,430
PB 240 GOTO130
KR 250 F$="EPSON FX-85"
EK 260 GOTO980
FC 270 :
SD 280 F$="EPSON LX-80"
RB 290 POKE31871,12:REM MOVE 2
       40DPI ICON 'X' POSITION
KH 300 POKE31876,15:REM MOVE F
       ILL ICON 'X' POSITION
RQ 310 POKE31880,0:REM DELETE
       {SPACE}144DPI ICON
BQ 320 GOTO980
JF 330 :
EA 340 F$="STAR SG-10"
QF 350 POKE31275,66:REM NLQ CO
       DE, BYTE 2
GK 360 POKE31276,4:REM NLQ COD
       E, BYTE 3
MJ 370 POKE31676,103:POKE31962
       ,103:POKE32018,103
CG 380 POKE31871,12:REM MOVE 2
       40DPI ICON 'X' POSITION
RA 390 POKE31876,15:REM MOVE F
       ILL ICON 'X' POSITION
ED 400 POKE31880,0:REM DELETE
       {SPACE}144DPI ICON
HC 410 GOTO980
HP 420 :
EH 430 F$="CUSTOM"
AR 440 PRINT"{DOWN}ENTER 4 BYT
       E NLQ CODE:"
KS 450 N=4:GOSUB1850
CP 460 POKE31274,D(1)
MK 470 POKE31275,D(2)
CQ 480 POKE31276,D(3)
KC 490 POKE31277,D(4)
FA 500 :
SX 510 PRINT"{DOWN}ENTER 2 BYT
       E 6 LINES/INCH CODE:"
DC 520 N=2:GOSUB1850
BQ 530 POKE31619,D(1):POKE3120
       2,D(1)
HG 540 POKE31620,D(2):POKE3120
       7,D(2)
KD 550 :
RM 560 PRINT"{DOWN}ENTER 3 BYT
       E 8/72 INCH CODE:"
BG 570 N=3:GOSUB1850
QX 580 POKE31621,D(1)
HC 590 POKE31622,D(2)
JD 600 POKE31623,D(3)
GH 610 :
AC 620 INPUT"{DOWN}SUBSTITUTE
       {SPACE}60 DPI FOR 72 DP
       I (Y/N)";Q$
DP 630 IF LEFT$(Q$,1)="N" GOTO
       670
AB 640 GOSUB1740
XP 650 PRINT"{DOWN}ENTER 3 BYT
       E 60 DPI CODE:"
XH 660 POKE31952,60:GOTO680
RB 670 PRINT"{DOWN}ENTER 3 BYT
       E 72 DPI CODE:"
AK 680 N=3:GOSUB1850
HX 690 POKE31957,D(1)
XJ 700 POKE31962,D(2)
GC 710 POKE31967,D(3)
HS 720 :
CA 730 PRINT"{DOWN}ENTER 3 BYT
       E 80 DPI CODE:"
PQ 740 N=3:GOSUB1850
JQ 750 POKE31675,D(1)
BD 760 POKE31676,D(2)
KB 770 POKE31677,D(3)
BJ 780 INPUT"{DOWN}IS THIS 240
        DPI CODE";Q$
CE 790 IF LEFT$(Q$,1)="Y" THEN
        POKE 31028,0:POKE31680
       ,3
FD 800 :
FB 810 INPUT"{DOWN}SUBSTITUTE
       {SPACE}120 DPI FOR 144
       {SPACE}DPI";Q$
MK 820 IF LEFT$(Q$,1)="N" GOTO
       860
EP 830 GOSUB1800
PM 840 PRINT"{DOWN}ENTER 3 BYT
       E 120 DPI CODE:"
DF 850 POKE31980,60:GOTO870
```

```
KB 860 PRINT"{DOWN}ENTER 3 BYT
       E 144 DPI CODE:"
FF 870 N=3:GOSUB1850
XP 880 POKE31985,D(1)
EM 890 POKE31990,D(2)
XS 900 POKE31995,D(3)
EM 910 :
EA 920 PRINT"{DOWN}ENTER 3 BYT
       E 240 DPI CODE:"
CJ 930 N=3:GOSUB1850
JD 940 POKE32013,D(1)
AF 950 POKE32018,D(2)
RH 960 POKE32023,D(3)
QS 970 :
JP 980 INPUT"{DOWN}PAPER SENSO
       R OFF (Y/N)";PSENSE$
RE 990 IF LEFT$(PSENSE$,1)="N"
       THEN POKE31618,57
XR 1000 INPUT"{DOWN}PRINTER DE
       VICE (4 OR 5)";PDEV
SJ 1010 IF PDEV=5 THEN POKE310
       26,PDEV
CA 1020 :
JD 1030 OPEN15,8,15,"S0:"+F$:C
       LOSE15
AM 1040 POKE780,1:POKE781,8:PO
       KE782,1:SYS65466:REM '
       SETLFS'
MR 1050 T$=F$:ZK=PEEK(53)+256*
       PEEK(54)-LEN(T$):POKE7
       82,ZK/256
EC 1060 POKE781,ZK-256*PEEK(78
       2):POKE780,LEN(T$):SYS
       65469:REM 'SETNAM'
AS 1070 POKE254,120:POKE253,4:
       POKE780,253:POKE782,12
       7:POKE781,64:SYS65496
JK 1080 IF(PEEK(783)AND1)OR(19
       1ANDST)THEN PRINT "ERR
       OR ON SAVE...":END
MB 1090 REM .....PRG TO GEOS C
       ONVERSION.....
DP 1100 OPEN15,8,15,"I0"
XG 1110 OPEN2,8,2,"#"
MP 1120 T$=CHR$(18):S$=CHR$(1)
SQ 1130 GOSUB1530
XS 1140 GOSUB1580:NT$=B$:GOSUB
       1580:NS$=B$
CD 1150 FOR E=0 TO 7
JS 1160 GOSUB1610
PD 1170 IF D$=F$ GOTO1220
BC 1180 NEXT E
DC 1190 IF NT$=CHR$(0) GOTO121
       0
SB 1200 T$=NT$:S$=NS$:GOTO1130
EH 1210 IF D$="" GOTO1490
KA 1220 DT$=T$:DS$=S$:REM DIRE
       CTORY T&S
MA 1230 T$=HT$:S$=HS$:GOSUB153
       0
BJ 1240 GOSUB1580:MT$=B$:GOSUB
       1580:MS$=B$:REM PRINT
       {SPACE}DRIVER 1ST T&S
CM 1250 FOR I=2 TO 67
RF 1260 GET#2,B$
QP 1270 NEXT I
FA 1280 GOSUB1580:CT$=B$:REM C
       OMMODORE FILE TYPE
GF 1290 GOSUB1580:GT$=B$:REM G
       EOS FILE TYPE
DM 1300 GOSUB1530:REM REREAD H
       EADER BLOCK
HB 1310 PRINT#2,CHR$(0);CHR$(2
       55);:REM SINGLE BLOCK
FP 1320 PRINT#2,CHR$(3);CHR$(2
       1);:REM GEOS FILE ICON
        IS 3 BYTES X 21 PIXEL
       S
HX 1330 GOSUB1560:REM WRITE HE
       ADER BLOCK
QA 1340 T$=DT$:S$=DS$:GOSUB153
       0:REM READ DIRECTORY T
       & S
PS 1350 GOSUB1580:GOSUB1580:RE
       M DUMMY READ OF NEXT T
        & S
EX 1360 IF E=0 GOTO1400
FF 1370 FOR I=1 TO 32*E:REM RE
       AD TO DIRECTORY ENTRY
RR 1380 GET#2,B$
XD 1390 NEXT I
GP 1400 PRINT#2,CHR$(128+3);:R
       EM CHANGE FILE TYPE TO
       'USR'
RS 1410 PRINT#2,MT$;MS$;:REM 1
       ST T&S OF PRINT DRIVER
        CODE
CH 1420 FOR I=1 TO 16:REM READ
        THRU FILENAME
JX 1430 GET#2,B$
AE 1440 NEXT I
RR 1450 PRINT#2,HT$;HS$;CHR$(0
       );GT$;
EH 1460 PRINT#2,CHR$(87);CHR$(
       12);CHR$(28);:REM DATE
SS 1470 PRINT#2,CHR$(12);CHR$(
       0);:REM TIME
JK 1480 GOSUB1560:REM WRITE DI
       RECTORY BLOCK
PB 1490 CLOSE2
PC 1500 CLOSE15
BR 1510 END
MA 1520 :
RB 1530 PRINT#15,"U1";2;0;ASC(
       T$);ASC(S$)
FP 1540 PRINT#15,"B-P";2;0
ED 1550 RETURN
GF 1560 PRINT#15,"U2";2;0;ASC(
       T$);ASC(S$)
MC 1570 RETURN
MF 1580 GET#2,B$:IF B$="" THEN
        B$=CHR$(0)
AE 1590 RETURN
GE 1600 :
RF 1610 D$=""
GH 1620 GOSUB1580:I=1:REM READ
        FILE TYPE
DB 1630 IF B$=CHR$(0) GOTO1690
HP 1640 IF ASC(B$)<>130 GOTO16
       90:REM CHECK FOR 'PRG'
        TYPE
CH 1650 GOSUB1580:HT$=B$:GOSUB
       1580:HS$=B$:I=3:REM GE
       OS 'HEADER BLOCK' T&S
XQ 1660 GOSUB1580:I=I+1
BM 1670 IF ASC(B$)=160 GOTO169
       0:REM END OF FILENAME
XM 1680 D$=D$+B$:GOTO1660
GK 1690 FOR I=1TO31:REM READ T
       O END OF DIRECTORY ENT
       RY
SS 1700 GET#2,B$
SE 1710 NEXT I
BR 1720 RETURN
FR 1730 :
XB 1740 REM MOVE 60DPI ICON RO
       UTINE
EE 1750 FOR I=0 TO 26
EG 1760 POKE 32050+I,PEEK(3227
       0+I)
PA 1770 NEXT
CA 1780 RETURN
AC 1790 :
QD 1800 REM MOVE 120DPI ICON R
       OUTINE
GP 1810 FOR I=0 TO 26
ES 1820 POKE 32148+I,PEEK(3229
       7+I)
RF 1830 NEXT
AF 1840 RETURN
GF 1850 :
MH 1860 FOR I=1 TO N
RQ 1870 PRINT"{2 SPACES}CODE("
       ;I;") = ";:INPUT D(I)
QK 1880 NEXT
XK 1890 RETURN
```

Program 2: Customizer

See instructions in article on page 42 before typing in.

```
7804:BF FF FF FF 80 00 01 A2 7D
780C:3F F1 B6 40 61 AA 57 61 B9
7814:A2 40 61 A2 42 61 80 80 D5
781C:C1 83 08 FD 85 00 CD 89 01
7824:FF DD 90 00 3D BF FF FD 85
782C:A0 00 79 A7 F3 71 A0 00 BD
7834:61 BF FF C1 80 00 01 80 68
783C:00 01 80 00 01 FF FF FF 85
7844:83 09 00 00 79 2D 7F 00 B8
784C:00 50 52 49 4E 54 44 52 CE
7854:49 56 45 52 A0 56 32 2E 3E
785C:30 00 00 00 00 44 4F 55 6A
7864:47 20 42 4C 41 4B 45 4C 1C
786C:45 59 00 00 00 00 00 00 56
7874:00 00 00 00 00 00 00 00 65
787C:00 00 00 00 00 00 00 00 6D
7884:00 00 00 00 00 00 00 00 75
788C:00 00 00 00 00 00 00 00 7D
7894:00 00 00 00 00 00 00 00 85
789C:00 00 00 00 4D 55 4C 54 3A
78A4:49 2D 44 45 4E 53 49 54 09
78AC:59 20 50 52 49 4E 54 45 F2
78B4:52 20 44 52 49 56 45 52 05
78BC:20 46 4F 52 20 55 53 45 A0
78C4:20 57 49 54 48 20 45 50 A7
78CC:53 4F 4E 20 46 58 2D 38 2D
78D4:35 20 4F 52 20 43 4F 4D 71
78DC:50 41 54 49 42 4C 45 20 53
78E4:50 52 49 4E 54 45 52 2E 2B
78EC:00 00 00 00 00 00 00 00 DD
78F4:00 00 00 00 00 00 00 00 E5
78FC:00 00 00 00 4C F3 7B 4C 63
7904:70 79 4C B0 79 4C D0 79 3A
790C:4C F5 79 4C 2E 7A 4C FD 88
7914:79 4C 05 7A 45 50 53 4F 80
791C:4E 20 46 58 2D 38 35 00 41
7924:00 00 00 00 00 00 00 00 17
792C:00 00 00 00 00 50 04 FF 68
7934:FF AD 32 79 20 B1 FF A9 E1
793C:F5 20 93 FF 20 AE FF 60 C0
7944:AD 32 79 20 B1 FF A9 E5 92
794C:20 93 FF 20 AE FF 60 AD 1A
7954:32 79 20 B1 FF A9 65 20 6F
795C:93 FF 60 8D 2E 79 A0 00 96
7964:B1 08 20 A8 FF C8 CC 2E AB
796C:79 D0 F5 60 A9 00 8D 30 AD
7974:79 AD 32 79 20 B0 C2 20 D6
797C:5C C2 A9 00 85 90 20 35 67
7984:79 A5 90 D0 12 20 53 79 ED
798C:20 68 7B 20 4F 79 20 A5 61
7994:79 20 5F C2 A2 00 60 48 82
799C:20 44 79 20 5F C2 68 AA 63
79A4:60 A2 00 A0 00 88 D0 FD 3C
79AC:CA D0 F8 60 AD 32 79 20 A7
79B4:B0 C2 20 5C C2 20 53 79 31
79BC:20 5C 7A A9 0D 20 A8 FF FA
79C4:A9 0A 20 A8 FF 20 4F 79 36
79CC:20 5F C2 60 AD 32 79 20 4F
79D4:B0 C2 20 5C C2 20 53 79 51
79DC:A9 0C 20 A8 FF A9 1B 20 33
79E4:A8 FF A9 32 20 A8 FF 20 48
79EC:4F 79 20 44 79 20 5F C2 FB
79F4:60 AE 31 79 A0 5E A9 00 53
79FC:60 A9 FF 8D 30 79 4C 75 D8
7A04:79 AD 32 79 20 B0 C2 20 68
7A0C:5C C2 20 53 79 A9 50 8D B9
7A14:31 79 A9 7A 85 09 A9 2A AA
7A1C:85 08 A9 04 20 5F 79 20 DC
7A24:4F 79 20 5F C2 60 1B 78 5F
7A2C:01 00 AD 32 79 20 B0 C2 EA
7A34:20 5C C2 20 53 79 A0 00 6C
7A3C:B1 02 F0 15 C9 0D D0 05 23
7A44:20 A8 FF A9 0A 20 A8 FF 30
7A4C:E6 02 D0 EC E6 03 4C 3C 36
7A54:7A 20 4F 79 20 5F C2 60 74
7A5C:20 29 7B B0 01 60 20 C1 B1
7A64:7B 20 88 7B A5 02 85 08 30
```

```
7A6C:A5 03 85 09 AC 2F 79 AD F8
7A74:C0 7B C9 03 F0 1D 98 48 87
7A7C:A0 00 B1 08 AE C0 7B 20 08
7A84:A8 FF CA D0 FA C8 C0 08 B8
7A8C:D0 F0 20 1D 7B 68 A8 88 53
7A94:D0 E4 60 A9 00 85 04 2C 1C
7A9C:34 79 10 2D 98 48 A0 00 06
7AA4:20 E9 7A 20 0A 7B C0 08 3D
7AAC:D0 F6 20 1D 7B 68 A8 88 F4
7AB4:D0 EA A9 0D 20 A8 FF 20 96
7ABC:AE 7B A5 02 85 08 A5 03 57
7AC4:85 09 AC 2F 79 A9 00 85 3F
7ACC:04 98 48 A0 00 20 0A 7B 0D
7AD4:2C 34 79 10 03 20 E9 7A 04
7ADC:C0 08 D0 F1 20 1D 7B 68 42
7AE4:A8 88 D0 E5 60 B1 08 2C CE
7AEC:33 79 30 02 25 04 20 A8 22
7AF4:FF A9 00 20 A8 FF B1 08 07
7AFC:85 04 C8 2C 33 79 30 02 73
7B04:31 08 20 A8 FF 60 A9 00 F8
7B0C:20 A8 FF B1 08 85 04 20 D6
7B14:A8 FF A9 00 20 A8 FF C8 01
7B1C:60 18 A9 08 65 08 85 08 5D
7B24:90 02 E6 09 60 AD 31 79 E6
7B2C:8D 2F 79 85 0A A9 00 85 A0
7B34:09 C6 08 A2 08 A0 03 20 75
7B3C:5D C1 18 A5 08 65 02 85 0F
7B44:08 A5 09 65 03 85 09 A0 01
7B4C:07 B1 08 D0 15 88 10 F9 26
7B54:38 A5 08 E9 08 85 08 B0 87
7B5C:02 C6 09 CE 2F 79 D0 E7 FC
7B64:18 60 38 60 A9 7B 85 09 DB
7B6C:A9 7F 85 08 2C 30 79 30 8E
7B74:05 A9 09 4C 5F 79 A9 06 78
7B7C:4C 5F 79 1B 40 1B 38 1B 4C
7B84:32 1B 41 08 A9 00 85 09 65
7B8C:AD 2F 79 85 08 A2 08 A0 29
7B94:03 20 5D C1 AD C0 7B 85 C9
7B9C:04 A2 08 A0 04 20 63 C1 72
7BA4:A5 08 8D BE 7B A5 09 8D 20
7BAC:BF 7B A9 7B 85 09 A9 BB AE
7BB4:85 08 A9 05 4C 5F 79 1B E3
7BBC:2A 04 80 02 01 A5 02 85 22
7BC4:08 A5 03 85 09 AE 2F 79 BC
7BCC:8A 48 78 A0 07 B1 08 A2 E5
7BD4:07 6A 7E 24 79 CA 10 F9 0D
7BDC:88 10 F2 58 A0 07 B9 24 B8
7BE4:79 91 08 88 10 F8 20 1D 48
7BEC:7B 68 AA CA 10 DA 60 A2 0D
7BF4:03 B5 02 48 CA 10 FA 20 4C
7BFC:3E 7C A0 00 B1 04 91 02 39
7C04:AD 1E 85 91 04 C8 C0 18 02
7C0C:D0 F2 20 51 7C CA 10 EA 5D
7C14:A9 68 85 02 A9 7C 85 03 1A
7C1C:20 56 C2 20 3E 7C A0 00 3A
7C24:B1 02 91 04 C8 C0 18 D0 33
7C2C:F7 20 51 7C CA 10 EF A2 34
7C34:00 68 95 02 E8 E0 04 D0 BD
7C3C:F8 60 A9 0D 85 02 A9 7E D5
7C44:85 03 A9 D0 85 04 A9 8C 1F
7C4C:85 05 A2 0B 60 A9 18 18 40
7C54:65 02 85 02 90 02 E6 03 AE
7C5C:A9 28 18 65 04 85 04 90 5C
7C64:02 E6 05 60 01 28 87 40 B6
7C6C:00 FF 00 0B 10 20 8E 7C B0
7C74:12 02 40 A7 7C 12 07 40 F3
7C7C:AF 7C 12 11 40 BF 7C 12 CB
7C84:14 40 C7 7C 12 0C 40 B7 51
7C8C:7C 00 18 53 45 4C 45 43 25
7C94:54 20 50 52 49 4E 54 45 60
7C9C:52 20 44 45 4E 53 49 54 4A
7CA4:59 3A 00 28 7D 00 00 03 4A
7CAC:10 CF 7C 59 7D 00 00 03 B5
7CB4:10 E8 7C 8A 7D 00 00 03 17
7CBC:10 EB 7C BB 7D 00 00 03 F2
7CC4:10 0C 7D EC 7D 00 00 02 35
7CCC:10 07 7D A9 48 8D 31 79 2E
7CD4:A9 1B 8D BB 7B A9 2A 8D 3B
7CDC:BC 7B A9 05 8D BD 7B A9 9C
7CE4:01 8D C0 7B 4C BF C2 A9 22
7CEC:48 8D 31 79 A9 1B 8D BB BB
7CF4:7B A9 2A 8D BC 7B A9 07 62
7CFC:8D BD 7B A9 02 8D C0 7B 79
7D04:4C BF C2 A9 00 8D 33 79 1E
7D0C:A9 1B 8D BB 7B A9 2A 8D 74
7D14:BC 7B A9 03 8D BD 7B A9 B5
7D1C:03 8D C0 7B A9 FF 8D 34 68
7D24:79 4C BF C2 B0 FF FF FE 97
7D2C:80 00 03 80 00 03 83 E7 CA
7D34:03 80 28 83 80 20 83 80 1A
7D3C:40 83 80 87 03 81 08 03 F1
7D44:82 08 03 82 08 03 82 0F 6B
7D4C:83 80 00 03 80 00 03 FF 63
7D54:FF FF 7F FF FF B0 FF FF 02
7D5C:FE 80 00 03 80 00 03 81 B2
7D64:C7 03 82 28 83 82 28 83 D0
7D6C:82 28 83 81 C8 83 82 28 BC
7D74:83 82 28 83 82 28 83 81 4C
7D7C:C7 03 80 00 03 80 00 03 49
7D84:FF FF FF 7F FF FF B0 FF D8
7D8C:FF FE 80 00 03 80 00 03 74
7D94:84 10 23 8C 30 63 84 50 6B
7D9C:A3 84 91 23 35 12 23 85 2F
7DA4:FB F3 84 10 23 84 10 23 9A
7DAC:8E 10 23 80 00 03 80 00 6C
7DB4:03 FF FF FF 7F FF FF B0 DD
7DBC:FF FF FF 80 00 00 80 00 C3
7DC4:00 8E 04 70 91 0C 88 81 3A
7DCC:14 88 81 24 98 8C 44 83 F5
7DD4:90 7E 88 90 04 83 90 04 39
7DDC:88 9F 04 70 80 00 00 80 10
7DE4:00 00 FF FF FF 7F FF FF DD
7DEC:A0 FF FE 80 03 9F F3 90 2F
7DF4:13 9B D3 9B F3 9B F3 98 23
7DFC:73 9B F3 9B F3 9B F3 91 58
7E04:F3 9F F3 80 03 FF FF FF 81
7E0C:FF 00 81 C7 03 82 28 83 AB
7E14:82 08 83 82 08 83 83 C8 0B
7E1C:83 82 28 83 82 28 83 82 F6
7E24:28 83 81 C7 03 84 71 C3 93
7E2C:8C 8A 23 84 0A 23 84 0A AE
7E34:23 84 72 23 84 82 23 84 5D
7E3C:82 23 84 82 23 8E F9 C3 07
7E44:00 00 00 00 00 00 00 00 41
7E4C:00 00 00 00 00 00 00 00 49
7E54:00 00 00 00 00 00 00 00 51
7E5C:00 00 00 00 00 00 00 00 59
7E64:00 00 00 00 00 00 00 00 61
7E6C:00 00 00 00 00 00 00 00 69
7E74:00 00 00 00 00 00 00 00 71
7E7C:00 00 00 00 00 00 00 00 79
7E84:00 00 00 00 00 00 00 00 81
7E8C:00 00 00 00 00 00 00 00 89
7E94:00 00 00 00 00 00 00 00 91
7E9C:00 00 00 00 00 00 00 00 99
7EA4:00 00 00 00 00 00 00 00 A1
7EAC:00 00 00 00 00 00 00 00 A9
7EB4:00 00 00 00 00 00 00 00 B1
7EBC:00 00 00 00 00 00 00 00 B9
7EC4:00 00 00 00 00 00 00 00 C1
7ECC:00 00 00 00 00 00 00 00 C9
7ED4:00 00 00 00 00 00 00 00 D1
7EDC:00 00 00 00 00 00 00 00 D9
7EE4:00 00 00 00 00 00 00 00 E1
7EEC:00 00 00 00 00 00 00 00 E9
7EF4:00 00 00 00 00 00 00 00 F1
7EFC:00 00 00 00 00 00 00 00 F9
7F04:00 00 00 00 00 00 00 00 03
7F0C:00 00 00 00 00 00 00 00 0B
7F14:00 00 00 00 00 00 00 00 13
7F1C:00 00 00 00 00 00 00 00 1B
7F24:00 00 00 00 00 00 00 00 23
7F2C:00 00 00 00 00 00 00 00 2B
```

Bug-Swatter

See instructions in article on page 62 before typing in.

Skeet—Corrected Version

```
C000:BF FF FF FE 80 10 02 80 1A
C008:7C 03 81 93 03 82 10 83 B7
C010:84 00 43 84 10 43 88 10 33
C018:23 88 00 23 9E D6 F3 88 40
C020:00 23 88 10 23 84 10 43 0B
C028:84 00 43 82 10 83 81 93 A1
C030:03 80 7C 03 80 10 03 80 DD
C038:00 03 FF FF FF 3F FF FF 77
C040:83 05 00 FC 04 AA 12 FC 80
C048:04 53 6B 65 65 74 20 20 C1
C050:20 20 20 20 20 56 31 2E DA
C058:36 00 00 00 00 00 00 00 F4
C060:00 00 00 00 00 00 00 00 E1
C068:00 00 00 00 00 00 00 00 E9
C070:00 00 00 00 00 00 00 00 F1
C078:00 00 00 00 00 00 00 00 F9
C080:00 00 00 00 00 FF FF FF 02
C088:FF FF FF FF FF FF FF FF 0A
C090:FF FF FF FF FF FF FF FF 12
C098:FF FF FF FF 00 85 05 A9 E3
C0A0:FF 85 06 85 07 20 8C 9D 0C
C0A8:68 85 02 68 85 03 A0 01 01
C0B0:68 91 02 88 68 91 02 20 41
C0B8:47 C2 20 35 C2 AD C4 88 C4
C0C0:8D 12 C0 29 20 F0 0E A0 B9
C0C8:06 B9 D8 C0 99 02 00 88 40
C0D0:10 F7 20 C8 C2 4C 2F 9F 2E
C0D8:00 84 00 79 00 05 00 20 47
C0E0:51 FA 20 4E CB 20 1C CC 96
C0E8:20 54 FD AD 9B 84 AE 9C 13
C0F0:84 20 D8 C1 58 B8 50 E7 22
C0F8:1E 30 DC EE 20 E1 C1 20 4C
C100:8A C1 A9 80 85 2F 20 A8 48
C108:C1 05 01 01 20 00 88 03 F2
C110:E8 00 30 07 20 00 88 05 95
C118:00 01 28 00 90 03 F0 00 53
C120:28 07 28 00 90 00 20 AE F1
C128:C1 62 00 49 20 43 6F 70 17
C130:79 72 69 67 68 74 20 31 37
C138:39 38 38 00 20 AE C1 4E FA
C140:00 5A 43 4F 4D 50 55 54 62
C148:45 21 20 50 75 62 6C 69 37
C150:63 61 74 69 6F 6E 73 20 3F
C158:49 6E 63 2E 00 20 AE C1 0B
C160:60 00 6B 41 6C 6C 20 72 5D
C168:69 67 68 74 73 20 72 65 35
C170:73 65 72 76 65 64 2E 00 D5
C178:A9 FF 8D 9C 09 8D 9D 09 0F
C180:CE 9D 09 D0 FB A9 FF 8D 15
C188:9D 09 CE 9C 09 D0 F1 20 50
C190:A8 C1 05 01 01 30 00 98 EA
C198:03 F8 00 20 07 30 00 98 6F
C1A0:05 00 01 37 00 A1 03 01 C7
C1A8:01 17 07 37 00 A1 05 09 60
C1B0:03 01 01 7F 07 37 00 A1 C4
C1B8:05 00 01 58 00 88 03 E0 6D
C1C0:00 98 07 58 00 88 05 01 FD
C1C8:01 D5 00 0D 03 FB 00 1B 36
C1D0:01 37 00 16 02 01 01 16 30
C1D8:00 20 AB C1 88 06 07 6F CF
C1E0:19 10 20 AE C1 5C 00 93 F6
C1E8:18 53 43 4F 52 45 3A 1B E1
C1F0:00 20 AE C1 98 00 93 18 72
C1F8:4F 55 54 20 4F 46 3A 1B 29
C200:00 A9 00 8D A8 09 8D A9 F6
C208:09 8D 62 06 8D AB 09 8D DC
C210:A4 09 8D A5 09 8D A6 09 0B
C218:8D A7 09 78 20 09 0E 20 58
C220:53 C2 09 42 02 01 2E 01 B6
C228:A9 63 8D 9B 84 A9 06 8D 2B
C230:9C 84 58 A5 01 8D 9A 09 07
C238:A9 35 85 01 A9 00 8D 17 20
C240:D0 AD 1E D0 AD 9A 09 85 D9
C248:01 A9 91 85 02 A9 07 85 8D
C250:03 A9 01 20 51 C1 A9 5D 26
C258:85 02 A9 07 85 03 20 5A 99
C260:C1 60 4C A5 3C C9 18 B0 AC
C268:03 4C EE 08 A5 3C C9 81 14
C270:90 03 4C EE 08 A5 3B F0 B5
C278:03 4C EE 08 A5 3A C9 38 D2
C280:B0 03 4C EE 08 4C CB 08 A8
C288:E5 03 88 00 00 00 00 30 03
C290:00 00 00 01 00 E5 03 88 4C
C298:00 00 00 00 60 00 00 00 21
C2A0:01 00 E5 03 88 00 00 00 D7
C2A8:00 80 00 00 00 01 00 E5 38
C2B0:03 88 00 00 00 00 60 00 9A
C2B8:00 00 01 00 E5 03 88 00 AA
C2C0:00 00 00 C8 00 00 00 01 D3
C2C8:00 E5 03 88 00 00 00 03 B3
C2D0:94 00 28 00 01 00 E5 03 7C
C2D8:88 10 00 00 35 69 00 72 68
C2E0:00 01 10 E5 03 88 08 00 51
C2E8:00 5B 5E 08 28 00 01 08 DC
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C2F0:E5 03 88 51 00 00 0E FB 68
C2F8:29 65 00 01 51 E5 03 88 2D
C300:E6 C0 00 1E 96 DD 5B 84 74
C308:01 E6 E5 03 88 AB 40 04 2E
C310:DF EF FE AA 82 01 AB E5 63
C318:03 88 D4 8E 42 AB B4 59 4A
C320:CD 6B 01 D4 E5 03 88 3B 5E
C328:7F 83 5F 5B 4E D7 D4 01 6E
C330:3B E5 03 88 EB DF 67 BD 23
C338:E9 EF 7E 59 01 EB E5 03 9C
C340:88 BF FF BD 7F F7 FF 2F E2
C348:BA 01 BF E5 03 88 DF FE BC
C350:FF 4A DF FF E7 7F 01 DF 85
C358:00 00 00 00 00 06 98 00 29
C360:48 4B 09 1D 88 02 10 5E 9C
C368:08 11 09 08 8B 02 0B B6 0B
C370:08 28 09 08 1D 02 11 AC 67
C378:09 28 09 08 68 02 11 B4 52
C380:09 28 09 1D 1D 02 11 AC 49
C388:09 28 09 1D 68 02 11 B4 B3
C390:09 09 17 D9 00 01 01 01 66
C398:D4 07 80 9D 07 09 42 02 19
C3A0:01 2E 01 84 CC 07 80 DC FC
C3A8:07 B8 07 00 6C 08 BE 07 CA
C3B0:00 7B 08 C6 07 00 8A 08 D9
C3B8:66 61 73 74 00 00 6D 65 C1
C3C0:64 69 75 6D 2A 00 73 6C FE
C3C8:6F 77 00 00 70 69 67 65 43
C3D0:6F 6E 73 00 6F 70 74 69 A9
C3D8:6F 6E 73 00 09 42 02 01 78
C3E0:2E 01 84 F7 07 00 08 08 20
C3E8:FB 07 00 1F 08 FF 07 00 70
C3F0:36 08 03 08 00 4D 08 31 EC
C3F8:30 00 00 32 30 2A 00 35 1B
C400:30 00 00 31 30 30 00 00 F6
C408:AD A6 09 C9 0A B0 0D 20 1D
C410:A7 08 A9 2A 8D F9 07 A9 53
C418:0A 8D 9E 0A 4C 5A 08 AD 08
C420:A6 09 C9 14 B0 0D 20 A7 5B
C428:08 A9 2A 8D FD 07 A9 14 B1
C430:8D 9E 0A 4C 5A 08 AD A6 23
C438:09 C9 32 B0 0D 20 A7 08 4A
C440:A9 2A 8D 01 08 A9 32 8D C3
C448:9E 0A 4C 5A 08 20 A7 08 EA
C450:A9 2A 8D 06 08 A9 64 8D 88
C458:9E 0A 20 90 C1 60 A9 06 A9
C460:8D 5D 07 20 BD C1 20 52 72
C468:0E 4C 02 05 20 9B 08 A9 C5
C470:2A 8D BC 07 A9 18 8D 3B 7E
C478:0A D0 1C 20 9B 08 A9 2A 3B
C480:8D C4 07 A9 20 8D 3B 0A 35
C488:D0 0D 20 9B 08 A9 2A 8D 44
C490:CA 07 A9 2A 8D 3B 0A 20 A6
C498:BD C1 60 A9 00 8D BC 07 CE
C4A0:8D C4 07 8D CA 07 60 A9 B8
C4A8:00 8D F9 07 8D FD 07 8D 45
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CD08:00 00 00 00 00 00 20 00 E3
CD10:00 00 00 00 00 00 00 00 AB
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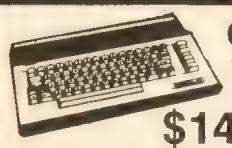

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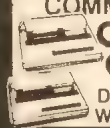

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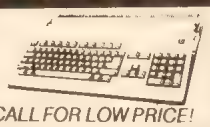

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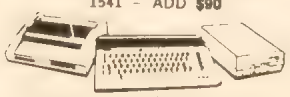

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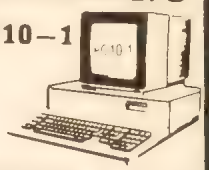

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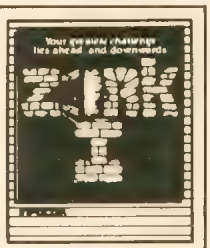

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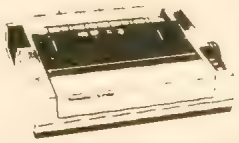

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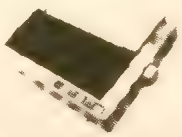

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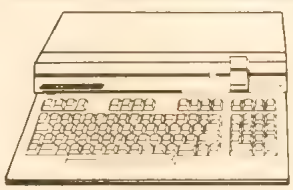

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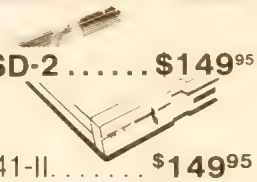

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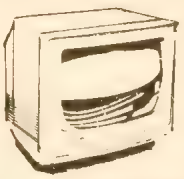

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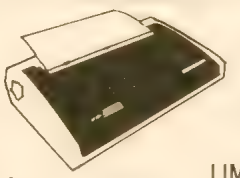

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How To Type In *COMPUTE!'s Gazette* Programs

Each month, COMPUTE!'s Gazette publishes programs for the Commodore 128, 64, Plus/4, and 16. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then on, erasing what was in memory. So be sure to *save a program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT}, and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

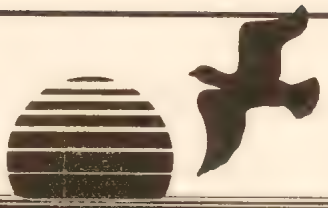
When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

Free Spirit Software Inc.



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- Menu-driven
- Auto Line Numbering
- Renumber
- ML Monitor
- List all variables to screen
- Hi-Res Screen Dump
- Restore newed Basic program
- Change Device number
- Packed Line Editor
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Dec., 1987

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The Automatic Proofreader

Philip I. Nelson

"The Automatic Proofreader" helps you type in program listings for the 128, 64, Plus/4, and 16 and prevents nearly every kind of typing mistake.

Type in the Proofreader *exactly* as listed. Since the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unfamiliar commands. After finishing, save a copy or two on disk or tape before running it. This is important because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Next, type RUN and press RETURN. After announcing which computer it's running on, the Proofreader displays the message "Proofreader Active". Now you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the Proofreader displays a two-letter checksum in the upper-left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If the letters don't match, check for your mistake and correct the line.

The Proofreader ignores spaces not enclosed in quotes, so you can omit or add spaces between keywords and still see a matching checksum. However, since spaces inside quotes are almost always significant, the Proofreader pays attention to them. For example, **10 PRINT"THIS IS BASIC"** will generate a different checksum than **10 PRINT"THIS ISBA SIC"**.

A common typing error is transposition—typing two successive characters in the wrong order, like PIRNT instead of PRINT or 64378 instead of 64738. The Proofreader is sensitive to the *position* of each character within the line and thus catches transposition errors.

The Proofreader does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it after typing it in, moving the cursor back to the line, and pressing RETURN. LISTing the line substitutes the full keyword for the abbreviation and allows the Proofreader to work properly. The same technique works for rechecking programs you've already typed in.

If you're using the Proofreader on the Commodore 128, Plus/4, or 16, *do not perform any GRAPHIC commands while the Proofreader is active.* When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing the Proofreader to crash. The same thing happens if you *run* any program with a GRAPHIC command while the Proofreader is in memory.

Though the Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. However, the Proofreader is purposely difficult to dislodge: It's not affected by tape or disk operations, or by pressing RUN/STOP- RESTORE. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (SYS 65341 for the 128, 64738 for the 64, and 65526 for the Plus/4 and 16). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

If you own a Commodore 64, you may already have wondered whether the Proofreader works with other programming utilities like "MetaBASIC." The answer is generally yes, *if you're using a 64 and activate the Proofreader after installing the other utility.* For example, first load and activate MetaBASIC, then load and run the Proofreader.

When using the Proofreader with another utility, you should disable *both* programs before running a BASIC program. While the Proofreader seems unaffected by most utilities, there's no way to promise that it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The New Automatic Proofreader

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
   ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

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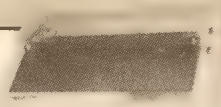

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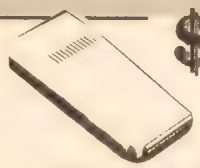

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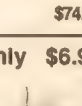

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MLX Machine Language Entry Program For Commodore 64

Ottis Cowper

"MLX" is a labor-saving utility that allows almost fail-safe entry of Commodore 64 machine language programs.

Type in and save some copies of MLX—you'll want to use it to enter future ML programs from COMPUTE!'s GAZETTE. When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

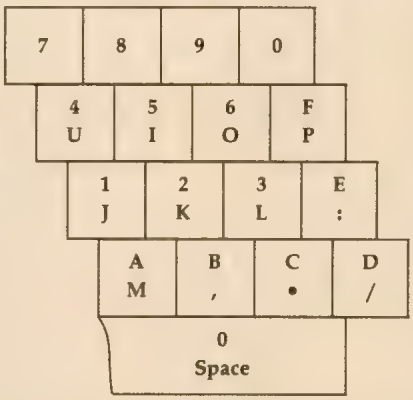
Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing.

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, the numeric keypad modification from the March 1986 "Bug-Swatter" column is now incorporated in the listing. The keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figure below shows the keypad configuration:



MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redis-

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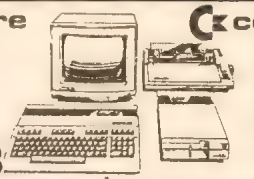

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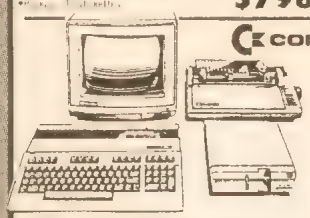

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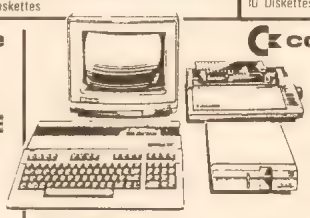

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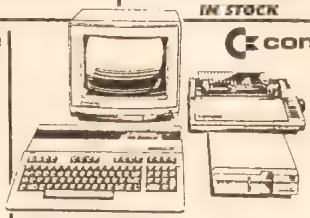

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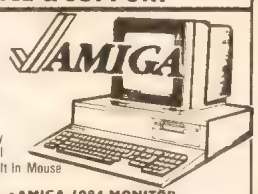

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played. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save. Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP–RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64. Other programs must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape, and then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, and then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to insure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
      30,950 MODIFIED, LINES 4
      85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
       I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
       4=254:Z5=255:Z6=256:Z7=
       127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
       :BS=PEEK(55)+Z6*PEEK(56
       ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
       :S$=" ":D$=CHR$(20):Z$=
       CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
       +23:POKE I,0:NEXT:POKE
       {SPACE}SD+24,15:POKE 78
       8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
       R$(8):POKE 53280,15:POK
       E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
       {2 SPACES}{8 @}
       {2 SPACES}"SPC(28)"
       {2 SPACES}{OFF}{BLU} ML
       X II {RED}{RVS}
       {2 SPACES}"SPC(28)"
       {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
       {3 SPACES}COMPUTE!'S MA
       CHINE LANGUAGE EDITOR
       {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
       RESS{4}";:GOSUB300:SA=A
       D:GOSUB1040:IF F THEN18
       0
GF 190 PRINT"{BLK}{2 SPACES}EN
       DING ADDRESS{4}";:GOSUB
       300:EA=AD:GOSUB1030:IF
       {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEA
       R WORKSPACE [Y/N]{4}";A
       $:IF LEFT$(A$,1)<>"Y"TH
       EN220
PG 210 PRINT"{2 DOWN}{BLU}WORK
       ING...";:FORI=BS TO BS+
       EA-SA+7:POKE I,0:NEXT:P
       RINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}
       {BLK}{RVS} MLX COMMAND
       {SPACE}MENU {DOWN}{4}":
       PRINT T$"{RVS}E{OFF}NTE
       R DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISP
       LAY DATA":PRINT T$"
       {RVS}L{OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE
        FILE":PRINT T$"{RVS}Q
       {OFF}UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=
       MID$("EDLSQ",I,1)THEN A
       =I:I=5
FD 270 NEXT:ON A GOTO420,610,6
       90,700,280:GOSUB1060:GO
       TO250
EJ 280 PRINT"{RVS} QUIT ":INPU
       T"{DOWN}{4}ARE YOU SURE
        [Y/N]";A$:IF LEFT$(A$,
       1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF
       LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$
       =MID$(IN$,3):GOSUB320:A
       D=AD*256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID
       $(B$,J,1):B=ASC(A$)-C4+
       (A$>"@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=
       0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(
       H$,B+1,1);:B=A-B*C6:PRI
       NT MID$(H$,B+1,1);:RETU
       RN
RR 360 A=INT(AD/Z6):GOSUB350:A
       =AD-A*Z6:GOSUB350:PRINT
       ":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*
       CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
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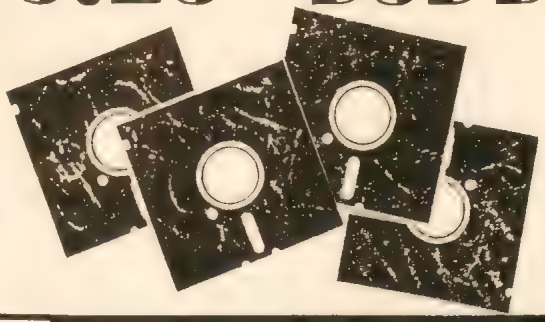

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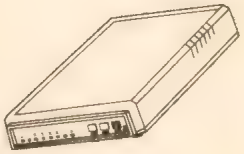

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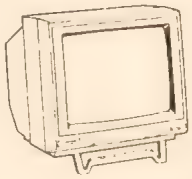

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```
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT
       [4]";:GOSUB300:IF IN$<>
       N$ THEN GOSUB1030:IF F
       {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA
       {SPACE}":GOSUB400:IF IN
       $=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F
        THEN PRINT IN$:PRINT"
       {UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$
       =S$:FOR J=1 TO 2:IF F T
       HEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<
       24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A
       $>"@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-
       3*(A$=".")-4*(A$="/")-5
       *(A$="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":
       ")-9*(A$="U")-10*(A$="I
       ")-11*(A$="O")-12*(A$="
       P")
CM 487 A=A-13*(A$=S$):IF A THE
       N A$=MID$("ABCD123E456F
       0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J
       =1)OR F)THEN PRINT B$;:
       J=2:NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRI
       NT B$:J=2:NEXT:I=24:NEX
       T:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF TH
       ENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR
       ((I=0)AND(J=1))THEN GOS
       UB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;
       :J=2-J:IF J THEN PRINT
       {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT
       {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}
       {5 RIGHT}";:INPUT#3,IN$
       :IF IN$=N$ THEN CLOSE3:
       GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=
       MID$(IN$,I):GOSUB320:IF
        I<25 THEN GOSUB380:A(I
       /3)=A
PK 570 NEXT:IF A<>CK THEN GOSU
       B1060:PRINT"{BLK}{RVS}
       {SPACE}ERROR: REENTER L
       INE [4]":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FO
       R I=0 TO 7:POKE B+I,A(I
       ):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN C
       LOSE3:PRINT"{DOWN}{BLU}
       ** END OF ENTRY **{BLK}
       {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS}
       {SPACE}DISPLAY DATA ":G
       OSUB400:IF IN$=N$ THEN2
       20
RJ 620 PRINT"{DOWN}{BLU}PRESS:
        {RVS}SPACE{OFF} TO PAU
       SE, {RVS}RETURN{OFF} TO
        BREAK[4]{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR
       I=BTO B+7:A=PEEK(I):GOS
       UB350:GOSUB380:PRINT S$
       ;
CC 640 NEXT:PRINT"{RVS}";:A=CK
       :GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA TH
       ENPRINT"{DOWN}{BLU}** E
       ND OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GO
       SUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOS
       UB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD
       {SPACE}DATA ":OP=1:GOTO
       710
PC 700 PRINT"{DOWN}{RVS} SAVE
       {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILE
       NAME[4]";IN$:IF IN$=N$
       {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK}
       {RVS}T{OFF}APE OR {RVS}
       D{OFF}ISK: [4]";
FP 730 GET A$:IF A$="T"THEN PR
       INT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8
       ,15,"I0:":B=EA-SA:IN$="
       0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":G
       OSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(A
       H*256):PRINT#1,CHR$(AL)
       ;CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CH
       R$(PEEK(BS+I));:IF ST T
       HEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOT
       O940
GS 800 GOSUB1060:PRINT"{DOWN}
       {BLK}ERROR DURING SAVE:
       [4]":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":G
       OSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z
       $)+256*ASC(B$+Z$):IF AD
       <>SA THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:P
       OKE BS+I,ASC(A$+Z$):IF(
       I<>B)AND ST THEN F=2:AD
       =I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F
       >0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN
        CLOSE1:CLOSE15:GOSUB10
       60:PRINT"{RVS}ERROR: "A
       $
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE
       187,PEEK(FA+3):POKE188,
       PEEK(FA+4):IFOP=0THEN92
       0
HJ 890 SYS 63466:IF(PEEK(783)A
       ND1)THEN GOSUB1060:PRIN
       T"{DOWN}{RVS} FILE NOT
       {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(8
       30):IF AD<>SA THEN F=1:
       GOTO970
SC 910 A=PEEK(831)+256*PEEK(83
       2)-1:F=F-2*(A<EA)-3*(A>
       EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:P
       OKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOS
       UB1010:ON OP GOTO950:SY
       S 63591
AE 940 GOSUB1080:PRINT"{BLU}**
        SAVE COMPLETED **":GOT
       O220
XP 950 POKE147,0:SYS 63562:IF
       {SPACE}ST>0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}**
        LOAD COMPLETED **":GOT
       O220
DP 970 GOSUB1060:PRINT"{BLK}
       {RVS}ERROR DURING LOAD:
       {DOWN}[4]":ON F GOSUB98
       0,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTIN
       G ADDRESS (";:GOSUB360:
       PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:
       AD=SA+AD:GOSUB360:PRINT
       D$:RETURN
FD 1000 PRINT"TRUNCATED AT END
       ING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH
       *256):POKE193,AL:POKE1
       94,AH
FF 1020 AH=INT(B/256):AL=B-(AH
       *256):POKE174,AL:POKE1
       75,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN
       1050
HA 1040 IF(AD>511 AND AD<40960
       )OR(AD>49151 AND AD<53
       248)THEN GOSUB1080:F=0
       :RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
       {SPACE}INVALID ADDRESS
        {DOWN}{BLK}":F=1:RETU
       RN
AR 1060 POKE SD+5,31:POKE SD+6
       ,208:POKE SD,240:POKE
       {SPACE}SD+1,4:POKE SD+
       4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
       TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
       240:POKE SD,0:POKE SD+
       1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
       KE SD+4,0:POKE SD,0:PO
       KE SD+1,0:RETURN
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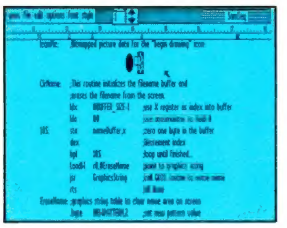

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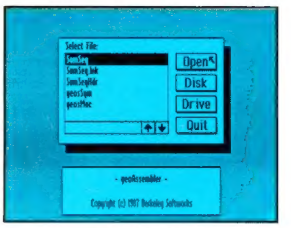

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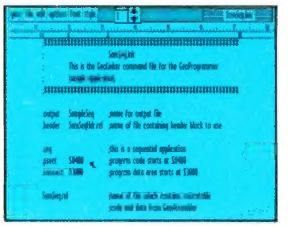

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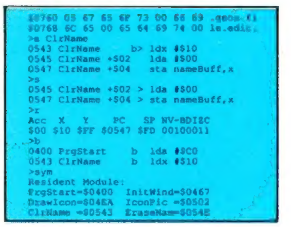

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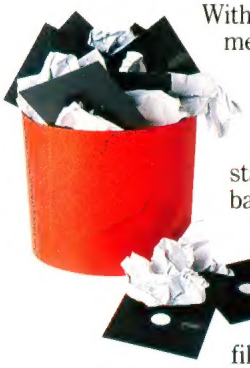

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